BUREAU OF WATER

SOUTH CAROLINA SOURCE WATER ASSESSMENT & PROTECTION PROGRAM

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health
and Environmental Control

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TABLE OF CONTENTS

Page

1.0 Introduction 1

1.1 Purpose and Scope 1
1.2 Drinking Water in South Carolina 1
1.3 Introduction to Source Water Protection 2
1.4 Public Participation 2
1.5 Pilot Studies 3

2.0 Delineation of Source Water Protection Areas 5

2.1 Groundwater Sources 5
2.1.1 Introduction 5
2.1.2 Geology of South Carolina 5
2.1.3 Delineation of Groundwater Sources in the Coastal Plain 6
2.1.4 Delineation of Groundwater Sources in the Piedmont 8
2.1.5 Groundwater Under the Influence of Surface Water 9

2.2 Surface Water Sources 9
2.2.1 Introduction 9
2.2.2 Determining the 24-Hour Instream Time-of-Travel Distance 10
2.2.3 Delineation of Critical Travel time Distance for Reservoirs 11
2.2.4 Delineation of Primary & Secondary Source Water Protection Areas 11
2.2.5 Delineation of Susceptibility Zone 1 12
2.2.6 Delineation of Susceptibility Zone 2 13
2.2.7 Delineation of Susceptibility Zone 3 13

3.0 Inventory of Potential Contamination Sources 15

3.1 Introduction 15
3.2 Contaminants of Concern 15
3.3 Significant PotentialContamination Sources 15
3.4 Conducting Potential Contamination Source Inventories 15
3.5 Data Management 16

4.0 Susceptibility Determinations 17

4.1 Introduction 17
4.2 Groundwater Systems 18
4.3 Surface Water Systems 21
4.3.1 Application of Susceptibility Zones 21
4.3.2 Susceptibility Analysis 23

TABLE OF CONTENTS

Page
5.0 Implementation.....25

5.1 Assessment Schedule.....25
5.2 Assessment Results.....25
5.3 Achieving a Voluntary Source Water Protection Program.....25
5.4 Bordering States.....26
5.5 Protection for New Water Systems.....26
5.6 Monitoring Waivers.....26
5.7 Funding Source Water Assessments.....26
5.8 Progress Reports to EPA.....26

References

Tables
Table 1 - Groundwater Susceptibility
Table 2 - Surface Water Susceptibility

Appendix A - Public Participation

Appendix B - Contaminants of Concern

Appendix C - Potential Significant Contamination Sources

Appendix D - Potential Contamination Source Inventory Form

Appendix E - Permitting Process for New Wells

Appendix F - SCDHEC Response to U.S. EPA Comments and U. S. EPA Approval Letter

1.0
INTRODUCTION

1.1 Purpose and Scope

The 1996 Amendments to the Safe Drinking Water Act (SDWA) require states to develop, submit to EPA, and implement (once approved), Source Water Assessment Programs (SWAP's). The implementing agency for the SDWA is the South Carolina Department of Health and Environmental Control (DHEC). The purpose of this document is to outline South Carolina's SWAP to meet this requirement.

The methods outlined in this plan to complete the assessments represent a technically-based approach given the limited time and financial resources currently available. In this way, every public water system can be given a "base-line" assessment from which to build and/or add layers of additional technical refinement.

1.2 Drinking Water in South Carolina

The State Primary Drinking Water Regulations (R.61-58) establish requirements for all public water systems to ensure safe drinking water throughout the state. These requirements can differ depending on the type of system. South Carolina categorizes its water systems as follows:

Community Water System: A public water system that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. This may include, but not be limited to, municipalities, subdivisions, mobile home parks, and apartments.

Non-Transient Non-Community Water System: A public water system that is ***not*** a community water system and that regularly serves at least 25 of the same persons more than 6 months per year (i.e., schools, and day care centers).

Transient Non-Community Water System: A non-community water system that ***does not*** regularly serve at least 25 of the same persons more than 6 months per year.

State Water System: A public water system that serves less than 15 service connections or regularly serves an average of less than 25 individuals daily.

As of January 7, 1999, the Department regulated approximately 2978 public water systems in the categories discussed above as follows:

734 Community Water Systems
250 Non-Transient Non-Community Water Systems
644 Transient Non-Community Water Systems
1350 State Water Systems

Of the 984 Community and Non-Transient Non-Community Water Systems, approximately 120 of those systems purchase their water from other public water systems.

Drinking water is provided to the citizens and visitors of South Carolina from either one of approximately 73 surface water sources (intakes) or 3800 groundwater sources (wells): 2268 which are Federally defined public water systems. Source Water Protection Assessments (SWPA's) will be completed for all Federally defined public water systems surface water and groundwater sources.

1.3 Introduction to Source Water Protection

There are three main components to the source water assessments: 1) delineation of a source water protection area, 2) inventory of certain potential contamination sources, and 3) determinations of susceptibility that provide for "the protection and benefit of public water systems."

States are required to involve the public in developing their SWAP's and to make the results of the assessments for public water supplies available to the public when completed. EPA expects that such information will encourage the development and implementation of complete local Source Water Protection (SWP) Programs, which incorporate the assessment and add the establishment of local SWP teams, source management, and contingency planning.

In order to be approved, a state submittal needs to contain a description of the following four items: 1) how the state achieved public participation in developing it's submittal, 2) the approach the state will take to conduct the source water assessments, 3) how the state will make the results of assessments available to the public, and 4) how the state will implement its chosen approach. The formation of a citizens and public advisory committee is also required.

1.4 Public Participation

Public participation is a key element in the development of the SWAP. The first step in achieving adequate public participation was the development of a Technical and Citizens Advisory Committee. The committee is comprised of members from diverse backgrounds. Representatives from industry, state agencies, federal agencies, water suppliers, health organizations, environmental groups, etc. have helped guide DHEC in development of the SWAP. A full listing of the Technical and Citizens Advisory Committee membership is enclosed in Appendix A.

The Technical and Citizens Advisory Committee met on December 2, 1997, May 14, 1998, and January 20, 1999. The Advisory Committee provided input on the proposed approaches and the "key issues" outlined in EPA's "State Source Water Assessment and Protection Programs Guidance"

published August 1997. Meeting notes are also included in Appendix A.

In addition to the Technical and Citizens Advisory Committee input, a series of seven public forums were held across the state in August, 1998. The meeting locations were: Columbia, Aiken, Florence, Greenville, Rock Hill, Charleston, and Beaufort. The following databases were used to compile a mailing list to notify people of the meetings: the Public Water System Inventory, the Watershed Database (government entities, general public and environmental groups), the Wetlands Program Database, and Technical and Citizens Advisory Committee list. A press release was issued in an effort to notify the public of meeting dates and locations. *The Florence Morning News, Lancaster News, The Island Packet, Beaufort Gazette, Hartsville Messenger, The Greenville News*, and the *Charleston Post and Courier* all ran notifications prior to the meetings. Additionally, the following associations ran articles in their newsletters: Lake and Watershed Association of SC, SC Rural Water Association, and the SC AWWA. The meeting schedule was also posted on the DHEC source water website. A copy of the meeting announcement is included in Appendix A.

The forums were held in the evening so the public could attend without interfering with their work schedule. The meetings were presented by DHEC staff and representatives of the University of South Carolina's Earth Sciences and Resource Institute (ESRI-USC). Carol Roberts of DHEC opened the meeting by showing a brief video that included information on possible contaminants to drinking water sources. The video also listed the steps included in a SWAP (delineation, contamination inventory, susceptibility analysis). Next, David Baize, SWAP Program Manager at DHEC, described the delineation methods proposed for use in determining protection areas for both groundwater and surface water sources. This information included methods provided by the United States Geological Survey (USGS) to calculate in-stream time-of-travel, overland flow contributions and groundwater contributions to surface water sources. Jim Rine and Buddy Atkins of ESRI-USC then explained the proposed contamination inventory methods. David Baize followed-up with a discussion of the proposed methods of susceptibility analyses that had been evaluated by USGS and DHEC. The forums were concluded with a question-and-answer session. The comments and DHEC's responses are tabulated in Appendix A.

After review by the Technical and Citizens Advisory Committee, this plan was posted on DHEC's web page for public review for 30 days. A copy of this plan was also provided to attendees of the public forums. Based on the comments received through the pilot studies (discussed later in this document), public forums, Technical and Citizen Advisory Committee meetings, and the 30 day public comment period, DHEC prepared this SWAP plan.

1.5 Pilot Studies

The United States Geological Survey (USGS) and the Earth Science and Resource Institute at the University of South Carolina (ESRI-USC) were contracted to assist DHEC in development of the SWAP. Specifically, the USGS developed methods that could be used state-wide to segment source water protection areas for surface water intakes and for assessing the relative susceptibility of these intakes to potential contamination sources. ESRI-USC evaluated existing databases, both inside and

outside of DHEC, as to their overall capability of fulfilling assessment requirements and to develop a prototype comprehensive inventory using a Geographic Information System (GIS).

Pilot study areas for developing and testing the methods were the City of Aiken intake on Shaw Creek as a Coastal Plain stream example, the Town of Belton-Honea Path intake on the Saluda River as a Piedmont stream example, and the City of Greenwood intake on Lake Greenwood as a reservoir example. The results of these pilot studies provide the basis for the approaches outlined in this plan.

2.0
DELINEATION OF SOURCE WATER PROTECTION AREAS

2.1 Groundwater Sources

2.1.1 Introduction

The 1986 Amendments to the Safe Drinking Water Act (SDWA) established the Wellhead Protection (WHP) Program to protect groundwaters that supply wells and wellfields contributing drinking water to public water supply systems. DHEC's WHP Program was approved by EPA in 1992. The approved delineation criteria will be used for the SWAP (described below). The terms "wellhead protection area" and "source water protection area" are considered to be synonymous for groundwater sources. DHEC will conduct the necessary delineations (and other required elements of the assessments) for the public water systems (PWS). PWS's will have the flexibility to augment the baseline assessment provided by DHEC.

2.1.2 Geology of South Carolina

The State of South Carolina can be divided into two major hydrogeologic settings: the Piedmont in the upper or more inland part of the State and the larger Coastal Plain in the lower or more coastward part of the State. The division between these two settings follows the Fall Line and is a northeast/southwest trending line that runs approximately from Augusta through Columbia to Cheraw (Figure 1). The aquifer systems of these two settings are very different.

The Piedmont aquifer system is basically two layered. A shallow water-table aquifer is composed of the saprolitic clayey residual soil, which is typically low yielding. The underlying bedrock aquifer consists of igneous and metamorphic rock which stores and transmits water through fractures. The shallow aquifer is unconfined, meaning that the upper surface of the saturated zone is not effectively separated from the ground surface by a low permeability clay layer. Due to the complexity of the bedrock fracture system, for the purposes of aquifer protection, this aquifer should also be considered unconfined and not effectively isolated (i.e., the saprolite and bedrock act as one interconnected aquifer system). Groundwater flow within this combined system can be very complex. The fractures, relic rock textures, directional differences in permeability or ease of groundwater movement may significantly affect the local groundwater flow direction. Recharging to the groundwater in the Piedmont is by the addition of rain water first to the shallow saprolitic aquifer and then to the uppermost fracture zone. Recharge mostly occurs on upland topographic highs or at least above the slopes of stream valleys.

The Coastal Plain is mostly composed of loose material (sands, clays, silts) but also includes one major porous rock aquifer (the limestone aquifer). These sedimentary materials overlie hard

South Carolina Hydrogeologic Settings

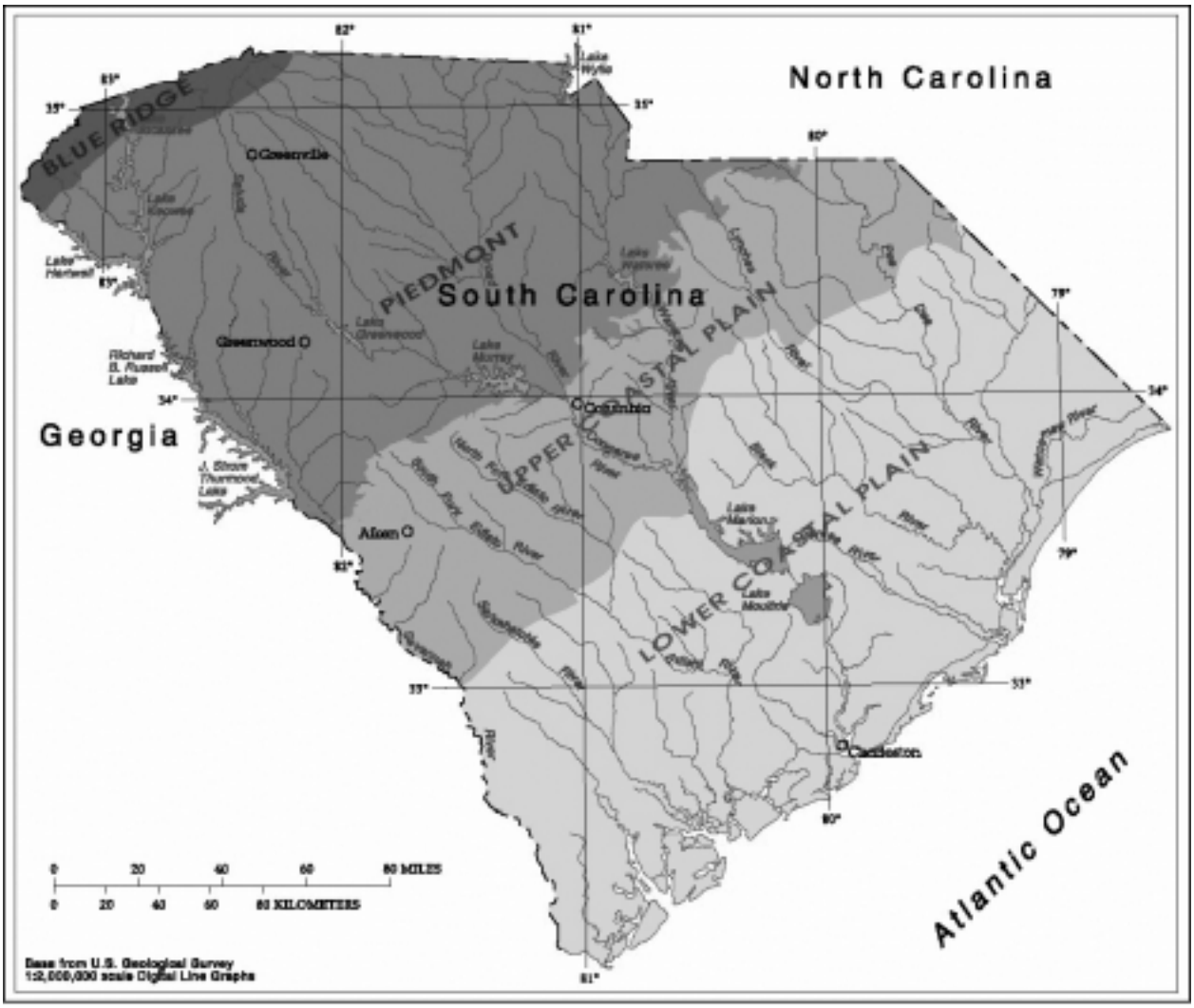


Figure 1

Cross Section of Coastal Plain of South Carolina

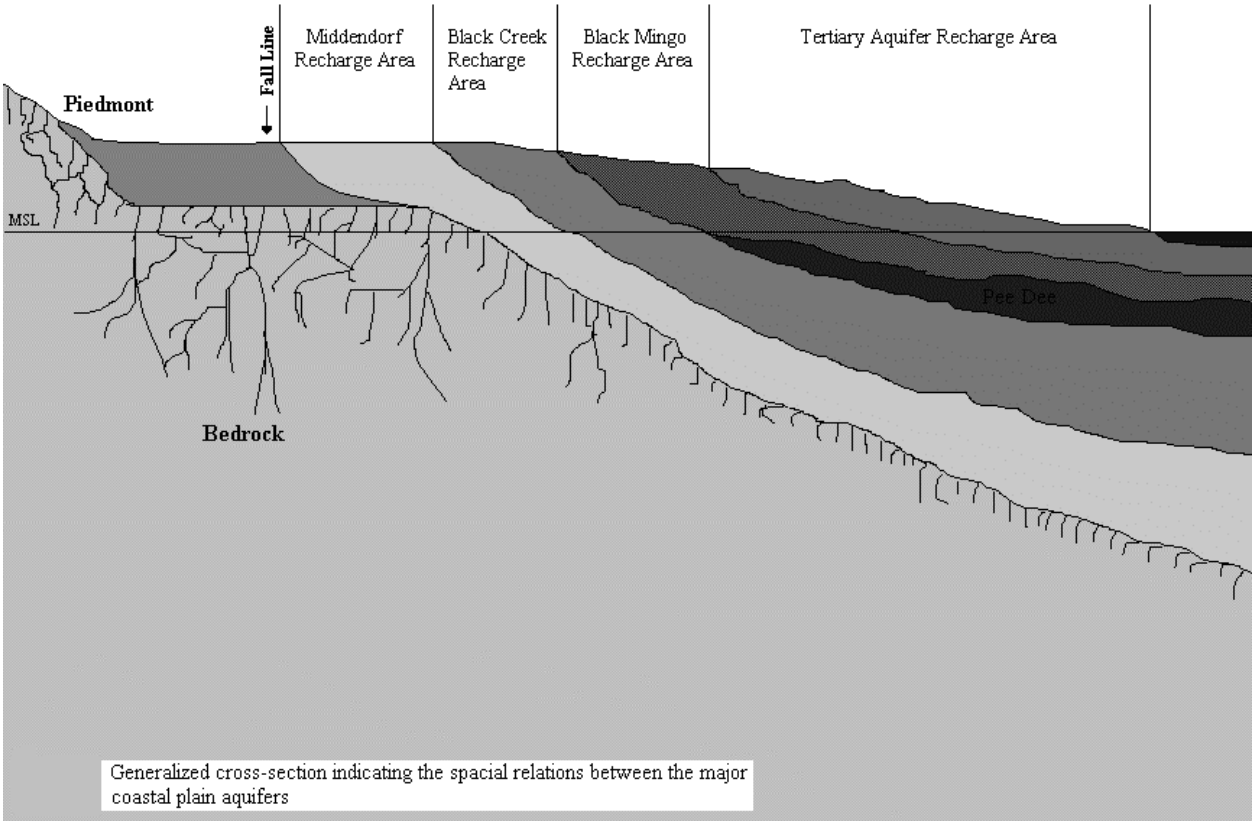


Figure 2

crystalline basement rock at considerable depths. The looser or unconsolidated sediments, and the limestone, thicken in a wedge shape from the Fall Line towards the Atlantic Ocean (Figure 2). Most aquifers of the Coastal Plain and the clayey strata that separate them into separate layers are quite large in areal extent, such that the recharge zone for many parts of those confined aquifers in the seaward half of the Coastal Plain may be miles inland.

These two major settings differ hydrologically in large measure and therefore they require different approaches in defining WHP Areas. The following discussion briefly outlines the approaches recommended as appropriate for South Carolina conditions.

2.1.3 Delineation of Groundwater Sources in the Coastal Plain

Groundwater systems (or aquifers) are characterized by certain physical properties, such as transmissivity, storativity, porosity, hydraulic gradient, and aquifer thickness. These measurements for a particular aquifer are needed in the various WHPArea delineation methods available. Wells/well fields also have important characteristics that must be known. These include screen (or open hole) length, well casing diameter, pumping rate, and the number and locations of wells.

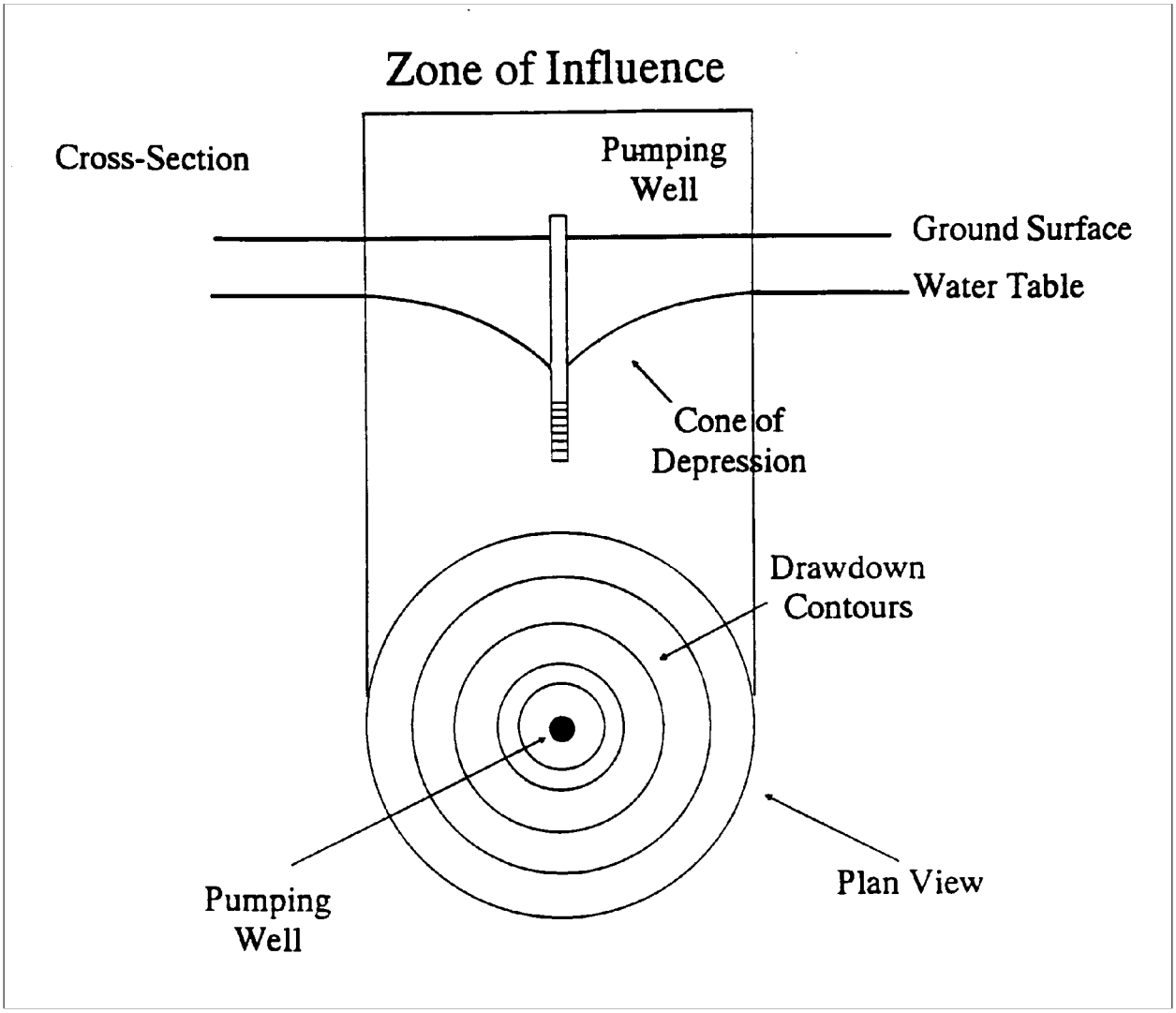
Information about these general characteristics for the well and aquifer being used is widely available, but it may require some effort to be found. Important sources include well records, the U.S. Geological Survey -Water Resources Division (South Carolina District), the Department of Natural Resources, and DHEC. Site-specific information obtained from pumping tests is much more accurate for the purpose of delineating WHP Areas, and should be used in preference to general data whenever possible.

Wellhead Protection Areas are based on identifying areas or zones of pumping influence (ZOI) and/or zones of water contribution (ZOC) for a pumping well.

The ZOI for a well is defined by the area of pumping influence or effect. In other words, it is that area where the water-table of an unconfined aquifer (or the potentiometric surface of a confined aquifer) is lowered by pumping from the well. Under ideal conditions and under conditions reasonably assumed for some lower coastal plain aquifers, the ZOI will be described by a circle around the pumping well representing the lateral extent of the cone of depression (Figure 3). Under these conditions, all groundwater within the ZOI will eventually enter the well. However, eventually groundwater from outside the ZOI will enter the well also, with this delay not readily estimated by this method.

If a natural hydraulic gradient is present and there is a significant rate of natural groundwater movement, the ZOI does not adequately define even the shape of the area contributing water to the well. Some portions of the ZOI will actually lie outside the area of contribution (Figure 4). When a natural hydraulic gradient is present, the ZOC is no longer circular but more elliptical in shape. As can be seen in Figure 4, water in the downgradient portion of the ZOI will actually flow away from the pumping well. Therefore, when a significant natural hydraulic gradient is present, the actual zone

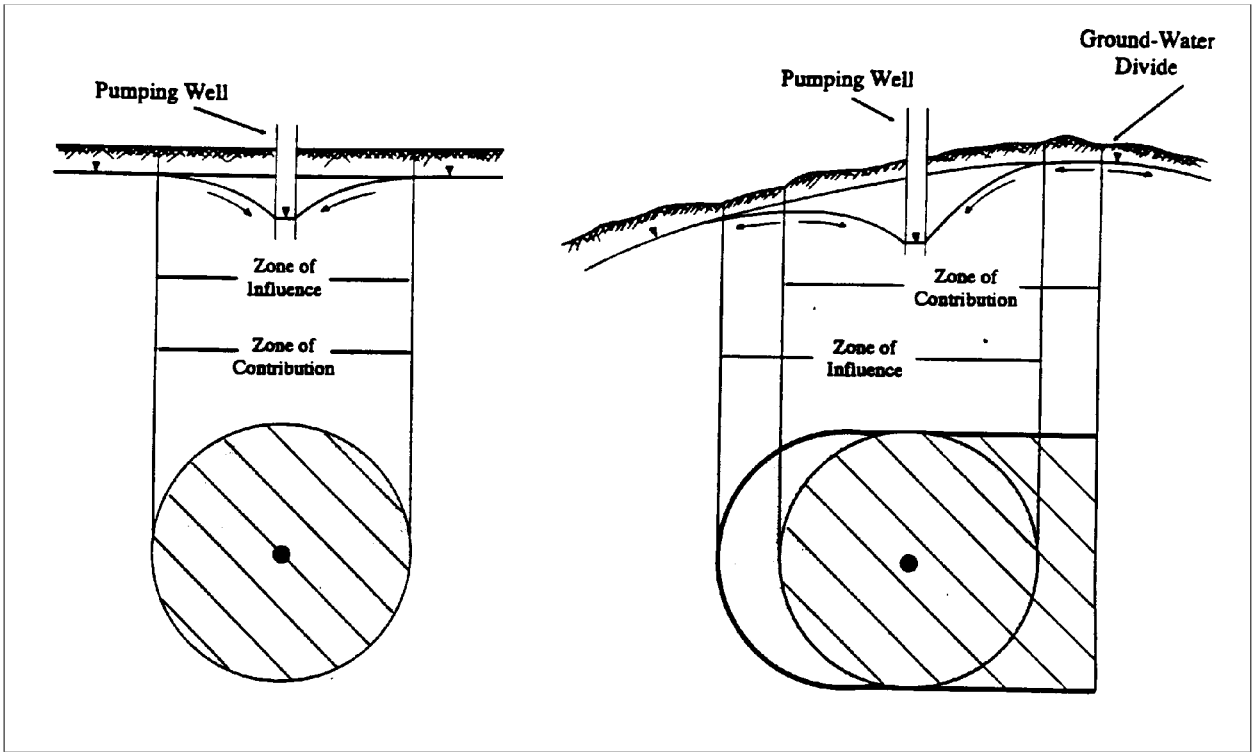
Zone of Influence of a Pumping Well



Under ideal conditions, the ZOI will be described by a circle around the pumping well. This represents the extent laterally that the water level is lowered by the pumping well.

Figure 3

Zone of Contribution for a Pumping Well



When a substantial natural hydraulic gradient or flow direction is present, the ZOI cannot adequately define the area contributing water to the well. Under these conditions the zone-of-contribution delineations should be used to represent that area contributing water to the pumping well.

Figure 4

of interest, the ZOC, is not well represented by the ZOI.

The ZOC is defined as the entire area of whatever shape which contributes or recharges water to a well or well field within a specified time period in years. The ZOC increases in areal extent with time unless detailed recharge effects are incorporated into the assessments. At small natural hydraulic gradients the difference in shape between the ZOI and ZOC may be minor enough to ignore, but the size (radius) can differ considerably. The ZOC estimate always best describes that area contributing water to a pumping well. Much better protection can be given through the use of computed ZOC delineations.

For the SWAP, a 10 year time-of-travel (TOT) will be calculated using computer models to estimate the ZOC and serve as the source water protection area. The TOT criterion relates to the time it takes groundwater to migrate from the outer boundary to the well, under pumping conditions. It more importantly describes the minimum time it would take for a dissolved contaminant to reach a well from outside the boundary. TOT incorporates a more comprehensive evaluation of the physical processes and aquifer characteristics involved in contaminant transport. Mass physical movement (advection) of a contaminant by means of groundwater flow is considered in the TOT calculations that are used to define a wellfield protection area. The time it takes for a contaminant to reach a well is affected not only by distance but also by the nearby hydraulic gradient. Because most of this local gradient results from the pumping of the well and this effect diminishes with distance from the well, the time-of-travel is not simply related to distance: doubling the distance more than doubles the time-of-travel. This method does not take into account numerous other factors which may affect the actual contaminant along its flow path, which may reduce, disperse, or dilute the maximum concentration of the contaminant. These can provide some additional margin of safety.

The Wellhead Protection Area (WHPA) computer model (developed for the US EPA) consists of four computational modules: RESSQC, MWCAP, GPTRAC, and MONTEC. These programs are not difficult to use and were developed specifically for EPA. Steady-state or stabilized conditions are assumed in all four modules. Steady-state conditions imply that an aquifer is under equilibrium conditions with long-term pumping. Therefore, variations in the balance between recharge and extraction (including changes in pumping) are not considered. Additionally assumed in the equation used by these programs is horizontal groundwater flow. This basically is achieved in confined aquifers, and is safely assumed in water-table aquifers if the drawdown is less than one-tenth of the initial saturated thickness (e.g., less than 10 feet of drawdown in a 100 foot thick aquifer). These assumptions are sufficiently realistic for most situations in South Carolina, once pumping has proceeded for more than a few days or weeks to approach stabilized conditions, and in any case minor differences are not critical to the outcome.

All four computer modules use the TOT criterion as the basis for the delineation of WHPA's. These modules delineate well capture zones for specified times and for a representative set of hydrologic conditions. Certain aquifer characteristics must be known or estimated before the computer modules can be used. The pumping rate (Q), transmissivity (T), porosity (n), hydraulic gradient (I), direction of groundwater flow, and aquifer thickness (b) are all required for these modules. The additional

characteristics required for these WHPA codes (hydraulic gradient and flow direction) allow the delineation of a WHPA that is more descriptive of the actual conditions existing in the well field.

Generally, the WHPA's developed with these hydrologic computer models are smaller in area than WHPA's defined by the less sophisticated methods (Theis equation, arbitrary fixed radius). The less sophisticated methods are all based on the assumption that the water table (or potentiometric surface for a confined aquifer) is flat, and thus no hydraulic gradient and no prevailing groundwater flow occur. However, this condition rarely exists. Normally, a hydraulic gradient is present and the prevailing flow direction elongates the zone of contribution "upstream" (Figure 4). Therefore, if the prevailing natural gradient is significant and the arbitrary or calculated fixed radius methods are used, the well will tend to be over-protected down-gradient while under protected up-gradient. The additional information required to run these modules (beyond that required by the less sophisticated methods) is the hydraulic gradient and the flow direction of groundwater.

An example of a typical delineated protection area in the Coastal Plain is shown in Figure 5. Note that one, five, and ten year TOT zones are provided.

2.1.4 Delineation of Groundwater Sources in the Piedmont

The fractured rock aquifer of the Piedmont requires a much different approach to delineation of protection areas from the Coastal Plain. Computer models cannot accurately be used to predict the flow of groundwater through the fractures in the rock to pumping wells. This is due, in part, to the nature of groundwater flow in bedrock, which occurs in the fracture systems and cannot be mathematically predicted with the same equations as flow in porous media in the Coastal Plain (mainly due to the unpredictable directions of the fractures).

For the Piedmont, a volumetric method based on pumping rate and recharge rate is used to define a contribution area for the well(s). This method is based upon recommendations for the State of North Carolina, "North Carolina Wellhead Protection Program - Applications Manual", an unpublished report prepared by the noted Hydrologist Ralph Heath. The following steps outline the application of the method:

1. Plot the location of the well on a map, such as a topographic sheet.
2. Find the pumping rate for the well. If it is in gallons per minute (gpm), multiply by 1440 (the number of minutes in a day) to get gallons per day (gpd).
3. Determine the recharge rate from the recharge-rate map (provided in the technical guidance).
4. Substitute these values into the following equation to determine the size of the contribution area:

   $A = Q/W$
   where:
   A = the area of contribution in square miles
   Q = the pumping rate in gpd
   W = the recharge rate in gpd/ square miles

Typical WHPA Delineation for the Coastal Plain of South Carolina

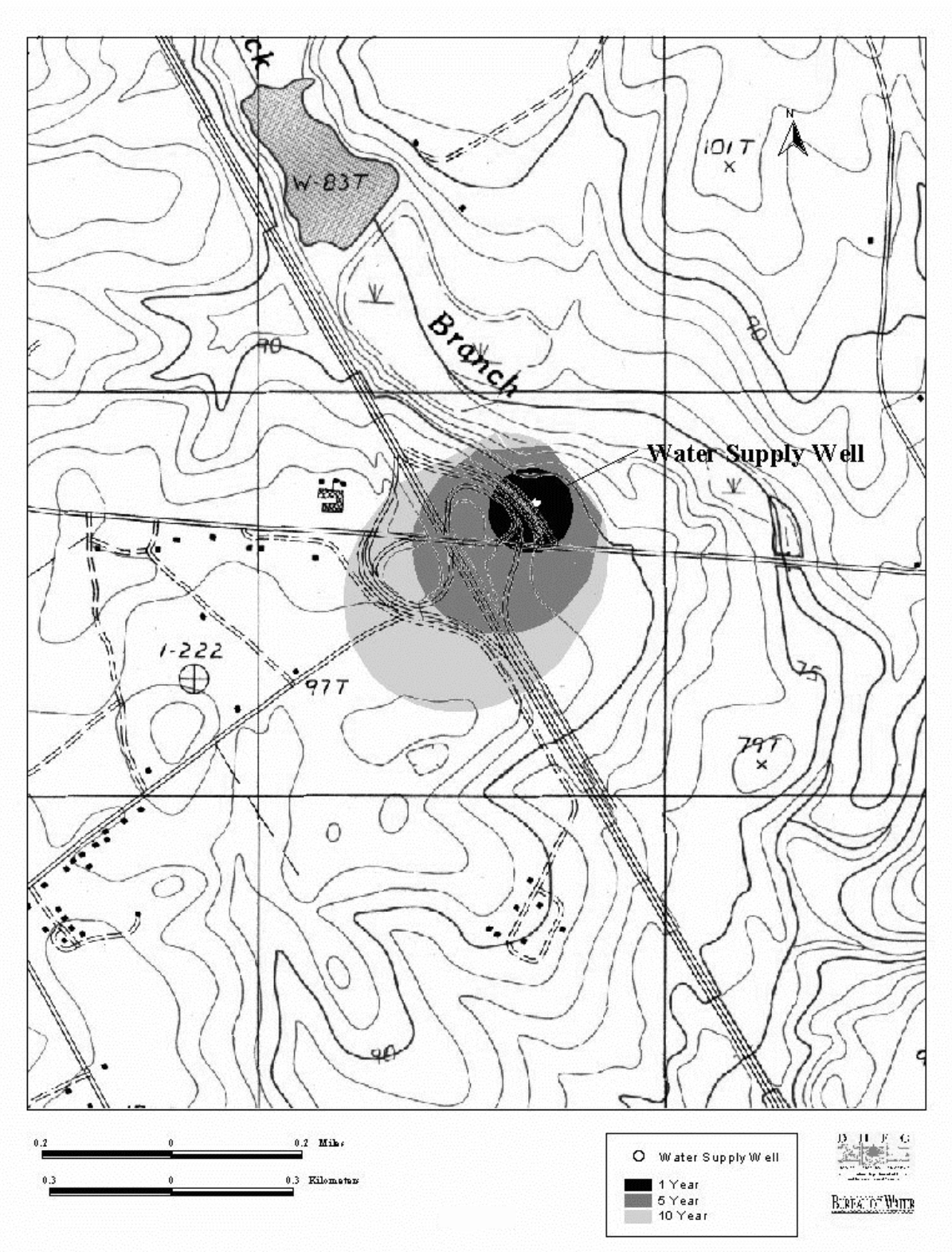


Figure 5

5. Convert the contribution area from square miles to square feet by using the following equation:

$$A\ (ft^2) = A(mi^2) \times \frac{(5{,}280\ ft)^2}{mi^2}$$

$$A\ (ft^2) = A(mi^2) \times \frac{27{,}878{,}400\ ft^2}{mi^2}$$

6. Multiply the contribution area by 2 to get $2A(ft^2)$. This computes the area of a circle that has a diameter equal to the major axis of an ellipse with an axial ratio of 2:1, which is done to account for a strong preferential direction of permeability and flow in Piedmont regolith and rocks.

7. Determine the radius of the circle from step 6 with the following equation:

$$\text{radius (ft)} = \sqrt{\frac{A\ (ft^2)}{pi}}\ , \text{ where pi} = 3.1412$$

A typical source water protection area delineated for the Piedmont is provided in Figure 6. This establishment of a circular protection area is more conservative than delineating an ellipse as the actual direction of groundwater flow to a pumping well in the Piedmont is not easily predicted.

2.1.5 Groundwater Under the Influence of Surface Water

A well that DHEC determines to be under the direct influence of surface water (i.e., the geologic formation between the well and the surface water is not acting as an adequate filter) is designated a surface water source and the water must be treated under provisions of the Surface Water Treatment Rule. Sources that are determined to be under the influence of surface water will have conjunctive delineations. The protection area will include the wellhead protection area plus the watershed protection area associated with the surface water body.

2.2 Surface Water Sources

2.2.1 Introduction

The Source Water Protection Area (SWPA) for a surface water system includes the entire drainage basin upstream from the intake to the hydrologic boundary of the drainage basin. The EPA recognized that an intake on a large reservoir or stream could have an extensive SWPA. To implement a cost-effective inventory and susceptibility determination, the EPA recommended segmentation of the SWPA. This included segmentation of the surface water flow system and the drainage basin. These segments could then be used to prioritize the inventory of contamination sources in areas closer to the intake and to assess the relative susceptibility of the intake to potential

Typical WHPA Delineation for Piedmont Area of South Carolina

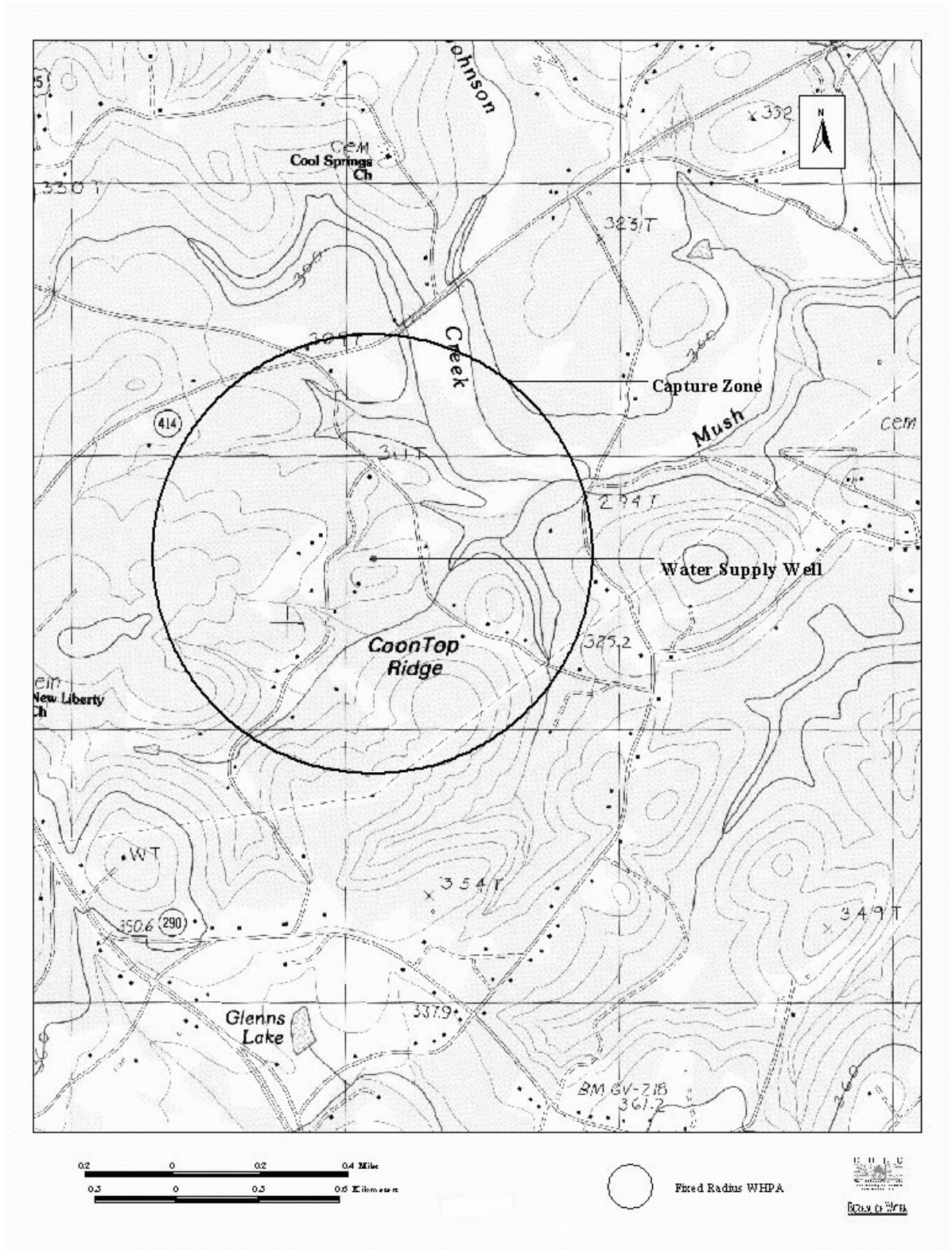


Figure 6

sources in different parts of the SWPA.

A public drinking water system that withdraws water from a stream or reservoir is susceptible to potential contamination sources in its drainage basin. Contaminants can enter a surface water system by: 1) direct spills to streams and reservoirs, 2) indirectly by overland runoff, and 3) groundwater derived from off-stream contamination sources. The physical and chemical properties of a potential contaminant and the location of its source in a drainage basin determine the likely pathways and, hence, travel time for the contaminant to reach the surface water, drinking water intake (referred to herein as intake). Therefore, travel time indicates the relative susceptibility of the intake and all three of the identified potential pathways are addressed by segmenting the drainage basin.

The segmentation methods include delineation of primary and secondary SWPA's within the drainage basin and delineation of susceptibility zones within the primary and secondary SWPA's. The primary SWPA is defined as a surface-water flow system and drainage area that is delineated by a calculated, in-stream 24-hour (hr) travel distance upstream from the intake, known as the critical travel distance. If the drainage basin is larger than the primary SWPA, the remainder of the basin upstream from the primary SWPA is the secondary SWPA.

The method to delineate a SWPA for a surface water intake is as follows:

1) Determine the 24-hour instream time-of-travel distance
2) Define the primary and secondary drainage basins (Source Water Protection Areas)
3) Define susceptibility zones one, two and three

2.2.2 Determining the 24-Hour Instream Time-of-Travel Distance

The 24-hour travel distance is used to provide an upstream limit to the SWPA for very large basins. For 33 surface water intakes in the state, we estimate that the entire drainage basin consists of only one Hydrologic Unit Code (i.e., the primary source water protection area includes the entire basin), so time-of-travel will not have to be calculated. We estimate that the 24-hour time-of-travel will need to be calculated for approximately 42 intakes with large basins.

The optimal method for estimating the travel time of a potential contaminant is to collect time-of-travel data for various flow conditions upstream from an intake. This data-intensive effort, however, is not feasible for most intake operators. Therefore, a simple method to estimate instream travel time is needed for streams where time-of-travel data are limited or are not available. The 24-hr travel distance computed for the 10-percent exceedance flow is the critical travel distance used to segment the SWPA.

The equations are defined as:

South Carolina Piedmont streams

$$V_p = 0.094 + 0.0143(D'_a)^{0.919} (Q'_a)^{-0.469} S^{0.159} Q/D_a \qquad (1)$$

South Carolina Coastal Plain streams

$$V_p = 0.020 + 0.051(D'_a)^{0.821} (Q'_a)^{-0.465} Q/D_a \quad (2)$$

where

V_p = *mean velocity of the peak concentration, in meters per second;*

D'_a = *dimensionless drainage area* $= (g^{0.5} \times D_a^{1.25})/Q_a$, (3)

g = acceleration of gravity, 9.81 square meters per second (m^2/s);

D_a = *average drainage area for the segment of interest, in square meters;*

Q_a = *average mean annual flow of segment of interest, in cubic meters per second;*

Q'_a = *dimensionless relative flow* $= Q/Q_a$, *(4)*

Q= average river flow at time of the measurement, in cubic meters per second; and

S = slope, meter per meter.

An example of the travel time calculated for Shaw Creek (from the pilot study conducted by the USGS) is shown in Figure 7.

2.2.3 Delineation of Critical Travel Time Distance for Reservoirs

The general movement of water in reservoirs is caused by the rates of inflow and outflow. However, this movement can be greatly influenced by both wind on the water surface and density differences due to thermal stratification of the reservoir. The optimal method for estimating travel time in a reservoir is to develop a simulation model, which requires large amounts of data and specialized training to run and interpret the results. Currently (1999), cost, time, and data restraints do not favor the development of reservoir models as an option. Therefore, if the intake lies within a reservoir, the delineation of the critical travel time segment will include the entire surface area of the reservoir and a 24-hour TOT distance from the headwaters by using the 10-percent exceedance flow on all major streams and tributaries that enter the reservoir.

2.2.4 Delineation of Primary and Secondary Source Water Protection Areas

Several intakes in South Carolina have large SWPA's with streams, tributaries, and reservoirs that extend a considerable distance upstream from the 24-hr travel distance. These large SWPA's can be divided into primary and secondary areas using the 24-hr travel distance and subwatersheds as criteria for separating primary from secondary. The subwatersheds used are delineated 14-digit hydrologic unit codes (Figure 8). These subwatersheds range in area from about 12.1 to 162 km^2.

A primary SWPA is defined as all subwatersheds adjoining the 24-hr travel distance upstream from the intake (Figure 9). Even if only a small part of the surface-water flow system in a subwatershed is part of the 24-hr travel distance, the entire subwatershed and all of its streams, tributaries, and reservoirs are included in the primary SWPA. If the intake is located on any part of a reservoir, the primary SWPA for the intake includes the entire surface area of the reservoir, a 24-hr travel distance on each stream upstream from the headwaters of the reservoir, and all subwatersheds adjoining the reservoir and the 24-hr travel distances on the inflow streams. The secondary SWPA for a stream or a reservoir intake is defined as all subwatersheds in the SWPA that are upstream from the primary

Time of Travel for Shaw Creek

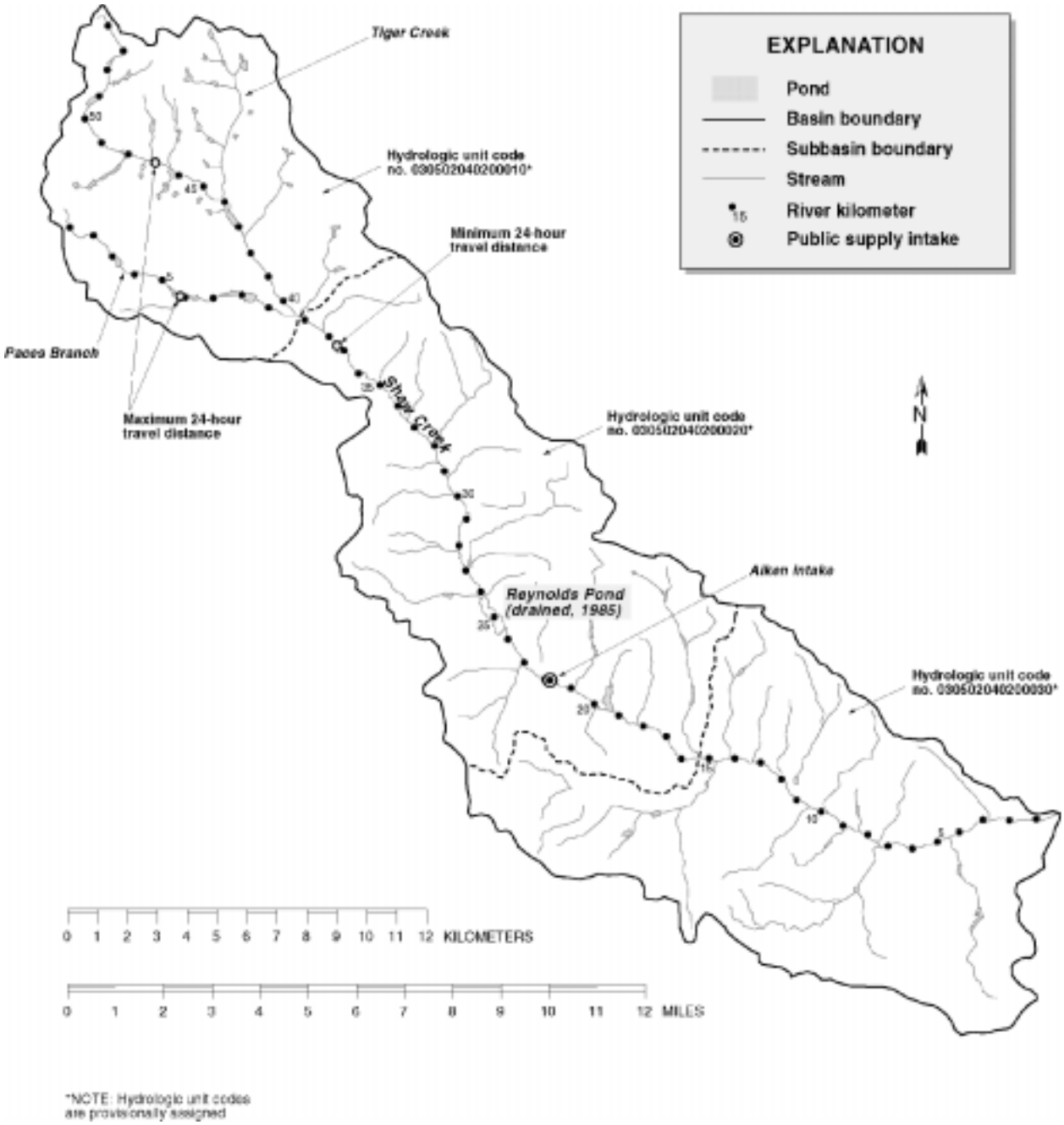


Figure 7

South Carolina's 14 Digit Hydrologic Units

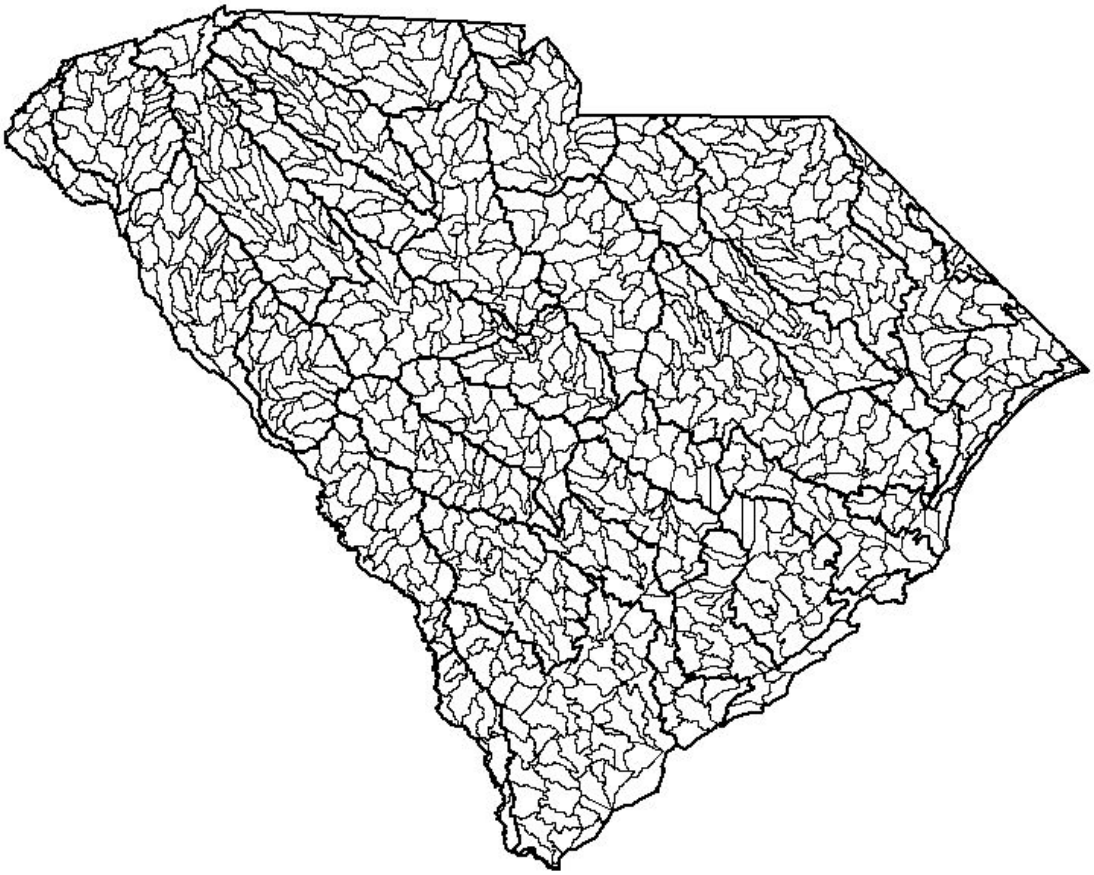
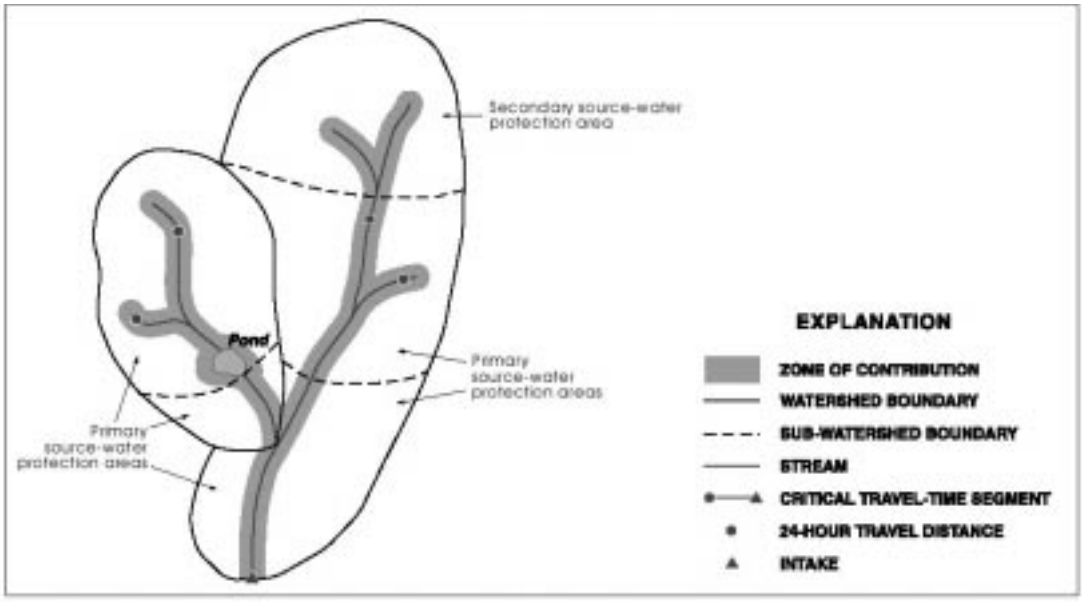


Figure 8

Primary and Secondary Source Water Protection Areas



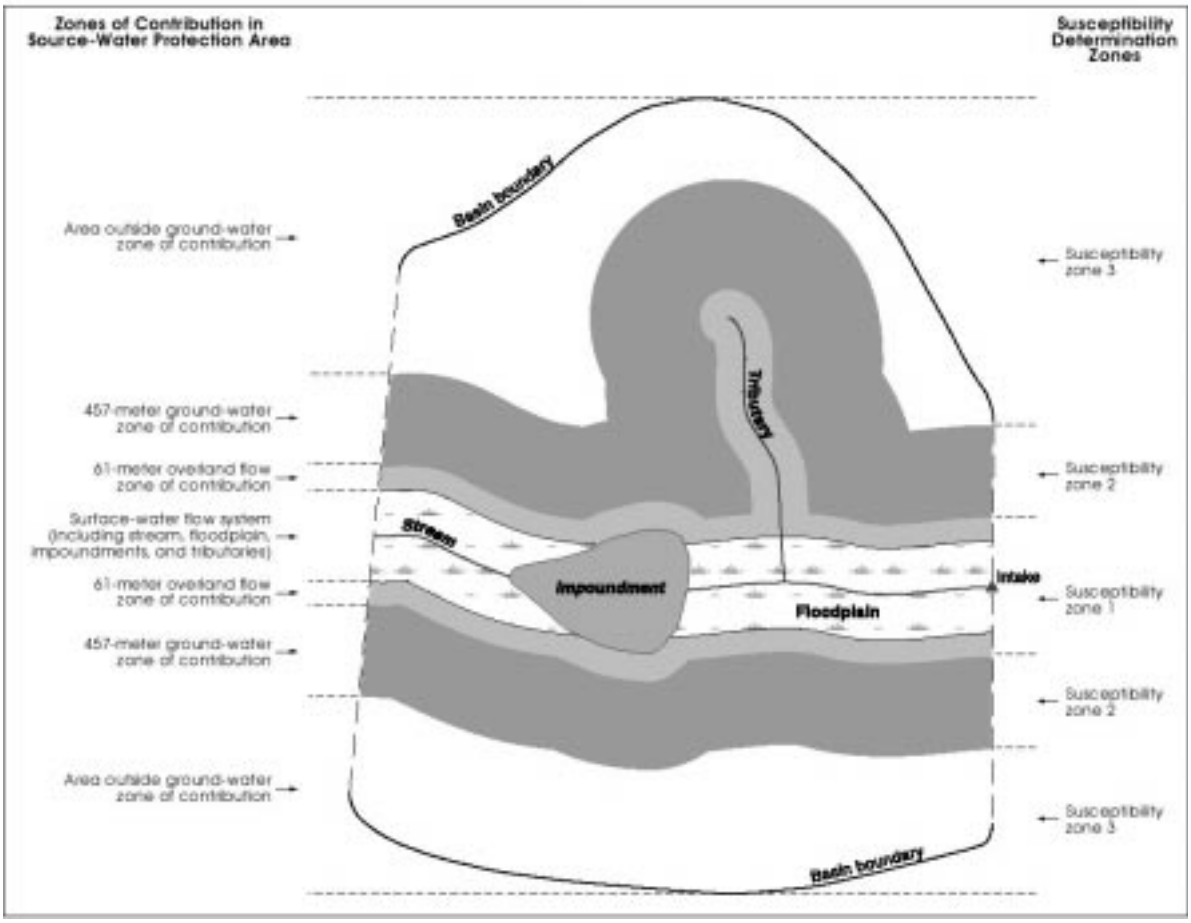


Figure 9

SWPA.

Potential contamination sources in the secondary SWPA are located farther from the intake than potential sources in the primary SWPA and have a longer instream travel time. The longer instream travel time from the secondary SWPA is assumed to represent a greater potential for dilution and attenuation of contaminants. Therefore, a contaminant entering the surface water flow system at a point in the secondary SWPA is less of a threat to the intake than the same contaminant entering the surface-water flow system at a point in the primary SWPA.

2.2.5 Delineation of Susceptibility Zone 1

The delineated SWPA's can be further divided into segments or zones that represent, in a very general way, relative susceptibility of the intake to potential contamination sources. For example, an identified potential source of petroleum 150 feet from the surface water may not represent the same relative threat to the intake as the same source located 2000 feet from the stream.

Land-use activities and other potential sources in areas adjacent to the surface water flow system are of concern because of the potential for transport of contaminants by overland flow and through groundwater rapidly recharging the surface water. Protecting and restoring natural riparian vegetation as a means of buffering waterways from pollution generated on adjacent lands has become a common best management practice. Vegetated riparian buffers, particularly forested riparian buffers, serve as natural filters, removing contaminants from overland flow. Conversely, the absence of such a buffer may indicate a greater potential for contaminants to enter the surface water via overland flow. Currently (1999), methods are available for computing the buffer widths. In addition, modeling of groundwater contaminants (discussed in more detail in the following section) shows an increased potential for an impact to the surface water via transport through the groundwater system should a release from a potential contamination source occur proximal to the surface water body.

The USGS evaluation suggests that waters with riparian buffers may be less susceptible to contamination from overland flow. Also, most contaminants in groundwater can be easily transported 200 feet from their source. Therefore, Susceptibility Zone 1 (SZ1) will be established 200 feet (61 m) from either the edge of the stream or from the edge of the geomorphic flood plain (Figure 10). For streams in the Piedmont and Upper Coastal Plain, SZ1 will be established from the edge of the stream. For streams in the Lower Coastal Plain (where wide floodplains and/or braided streams may occur), SZ1 will be established from the edge of the geomorphic flood plain. The 200 foot SZ1 will be applied from the edge of reservoirs as well. The lack of any inventoried potential contamination sources in SZ1 does not imply that adequately designed and maintained Best Management Practices exist or that the occurrence of a potential source in SZ1 indicate the absence of an appropriate buffer.

SZ1 does not represent all areas that contribute overland flow to the water body of interest. Because potential contamination sources located within this zone may not have the needed buffer width

Susceptibility Zone 1

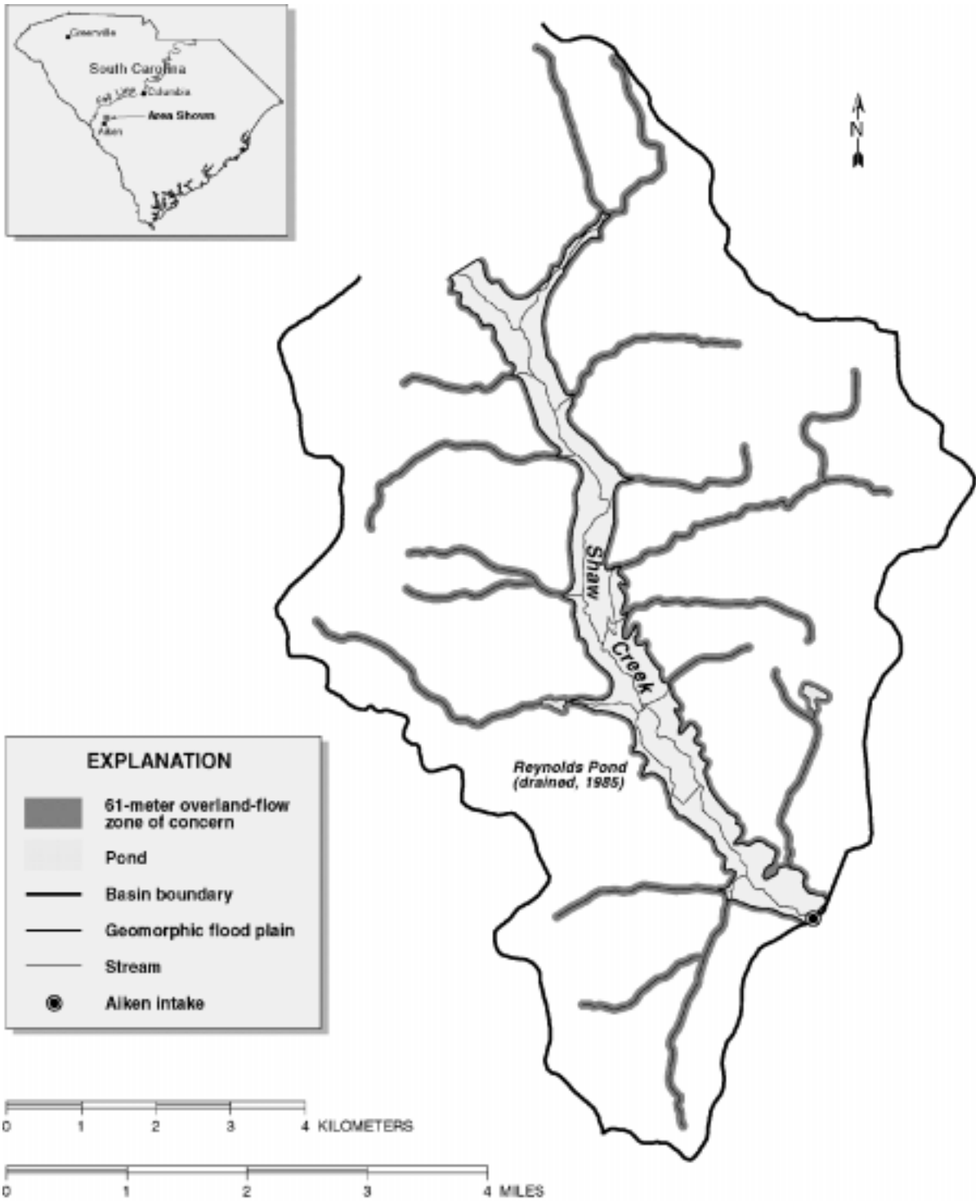


Figure 10

between them and the water body, a greater chance of contaminating the source water exist than with potential contamination sources outside the zone. Also, road ditches or small channels that exist within this zone of concern could transport contaminants from outside the zone of concern to the water bodies; therefore, land-use maps need to be used to identify potential contamination sources or activities within the basin. This information needs to be "overlaid" with the topographic map of the basin, along with the road and railroad locations within the basin. If the potential contamination sources have pathways or potential pathways to the water body, these sources should be identified as being within the zone of concern for overland flow as well.

2.2.6 Delineation of Susceptibility Zone 2

Susceptibility Zone 2 (SZ2) is established as a zone of concern, based on proximity to the surface water and associated travel time of potential contaminants, but as an area of relatively less concern than the very rapid overland flow and groundwater discharge typical of SZ1. In addition to continued concerns about overland flow, groundwater contaminants can migrate away from off-stream sources within a drainage basin and threaten the quality of the surface water flow system. Potential sources of ground-water contaminants in close proximity to the surface water flow system are assumed to experience less attenuation of contaminants and to represent a greater threat to an intake than do potential sources that are located farther away. In addition to groundwater flow, the physical and chemical properties of potential contaminants need to be considered to fully assess potential natural attenuation of contaminants.

The USGS used a solute transport modeling code developed for the EPA to simulate the maximum contaminant plume lengths for dissolved gasoline and trichloroethylene (TCE), a chlorinated organic solvent, for a range of groundwater flow conditions and contaminant-specific properties. Gasoline and TCE are identified as the two most frequently encountered ground-water contaminants in South Carolina. To simulate this possible range in hydraulic-flow conditions in South Carolina, input values for seepage velocities ranging from 0.305 to 305 m/yr were used. Simulations with a seepage velocity of 305 m/yr were used to account for worst-case conditions that could occur in fractured rock or extremely transmissive sedimentary aquifers in areas with unusually steep hydraulic gradients.

Based on the modeling results, most of the potential sources of gasoline and TCE that represented the greatest threats to a surface water system in a SWPA would reasonably attenuate to below their maximum contaminant level within 1500 feet (457 m). SZ2 applies to the main streams, the perimeter of reservoirs, and all perennial tributaries in a SWPA (Fig. 11). Application of SZ2 to channels with intermittent or storm-related discharge requires special consideration, particularly if the channel drains an area near an inventoried potential contamination source.

2.2.7 Delineation of Susceptibility Zone 3

Susceptibility Zone 3 (SZ3) is simply the remainder of the 14-digit HUC drainage basin. SZ3 represents relatively less concern over impacts to surface water from overland flow or groundwater discharge than SZ2 and SZ1, but the potential for impacts from contamination sources in this zone

Susceptibility Zones 1, 2, and 3

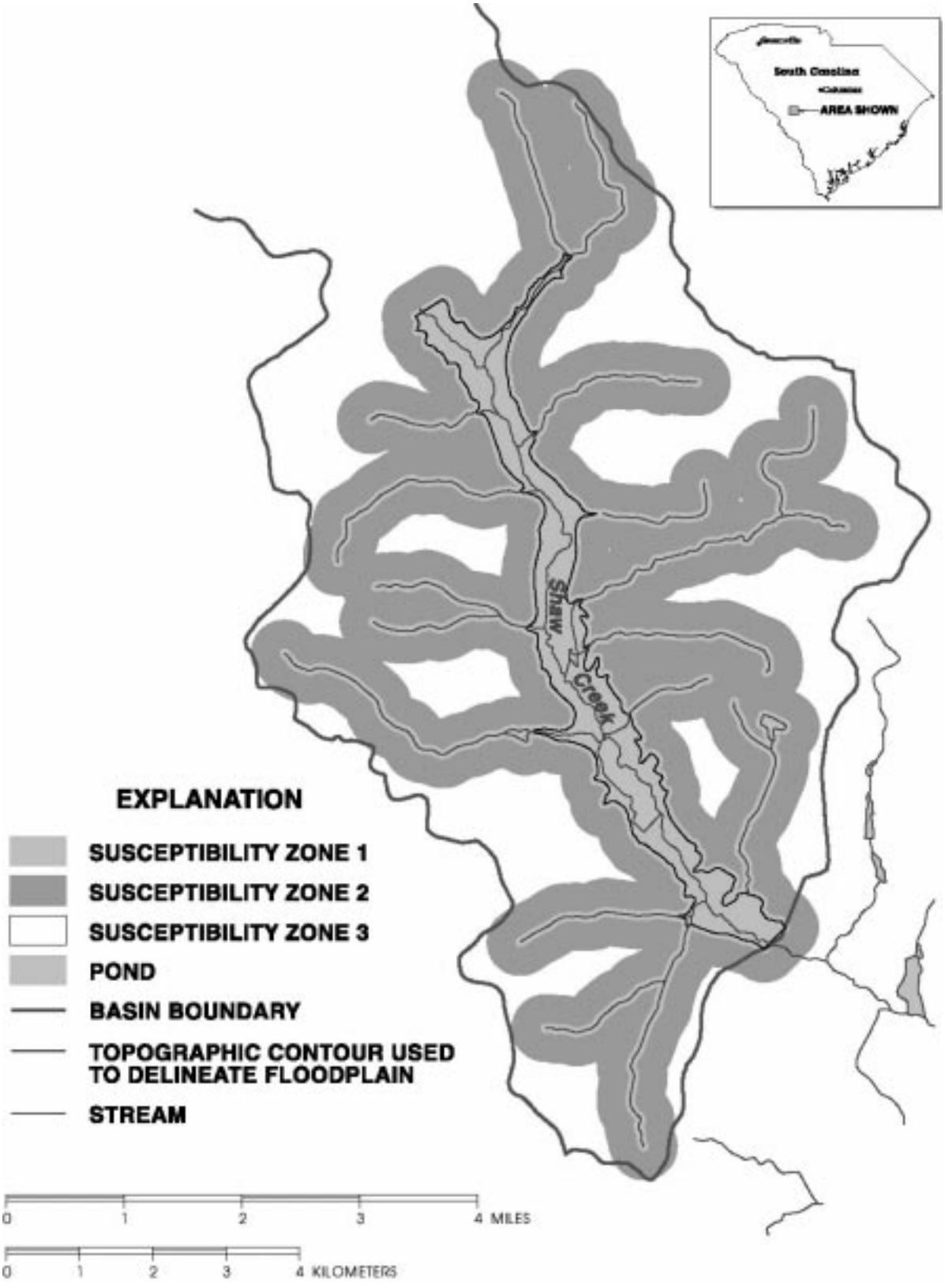


Figure 11

still exist.

3.0
INVENTORY OF POTENTIAL CONTAMINATION SOURCES

3.1 Introduction

States are required to identify what "contaminants of concern" the SWAP will address and what "significant potential sources" of these contaminants the program will inventory in the assessment. This chapter addresses these issues and describes how the data will be managed.

3.2 Contaminants of Concern

Contaminants of concern that will be inventoried (at a minimum) include the contaminants regulated under the SDWA (i.e., contaminants with a maximum contaminant level) and the microorganism *Cryptosporidium* (including other pathogens). A list of these contaminants is provided in Appendix B.

3.3 Significant Potential Contamination Sources

All potential sources of contamination inventoried, including regulated sources and unregulated sources listed in Appendix C, are considered significant potential sources. A significant Potential Contamination Source (PCS) is defined as any facility or activity that stores, uses, or produces, as a product or by-product, the contaminants of concern and has sufficient likelihood of releasing such contaminants to the environment at levels that could contribute significantly to the concentration of these contaminants in the source waters of the public supply. PCS's include Superfund sites, Toxic Release Inventory sites, National Pollutant Discharge Elimination System (NPDES) permits, underground storage tanks, RCRA sites, landfills, agricultural operations, animal feeding operations, and activities associated with non-point pollution.

3.4 Conducting Potential Contamination Source Inventories

Based on the inventory completed by ESRI-USC for the Shaw Creek intake during the Pilot Study, approximately 50% of the PCS's could be identified by searches of existing databases, but the remaining 50% of the PCS's could only be located by conducting a "windshield" survey. This is significant in that the available databases can only tell us half of the information needed to complete the inventory. Therefore, the potential contamination source inventory will be conducted in two steps. The first step is to search existing databases to identify known contaminated sites, permitted sites, general land-use, and other GIS-based analyses such as identification of roads and railroads crossing streams in the protection area. Step two will be to conduct windshield surveys to ground truth the results of the database search and to inventory PCS's not previously identified. An inventory form is included as Appendix D.

The geographical extent of the inventory is of concern due to the limited time and monies allotted to

conduct these assessments. The best scenario would be to have all PCS 's in every basin on the inventory. However, the large size of some basins may make this ultimate goal initially unobtainable. For the basins where a time-of-travel is not calculated (i.e., the entire drainage basin consists of only one HUC), an inventory of all PCS's in the entire basin will be completed. For larger basins (i.e., where primary and secondary basins have been delineated), the goal will be to have a completed inventory of all PCS's in the basin, but the physical extent of the windshield inventory may be adjusted as resources allow as described below:

Minimum Windshield Inventory

Intake within one HUC basin: inventory entire basin
Primary and Secondary basins: inventory Susceptibility Zones 1 and 2
Groundwater Systems: inventory within the 10 year TOT

Optimal Windshield Inventory (should resources allow)

Intake within one HUC basin: inventory entire basin
Primary and Secondary basins: inventory entire basin
Groundwater Systems: inventory within the 10 year TOT

The available information about a facilities operation (taken from databases, routine reporting, etc.) is often limited to the type of contaminant of concern used. The mere presence or use of a regulated contaminant, however, does not completely describe the actual risk of a release to the environment from that facility or activity. The amounts of the contaminant produced, stored or used, the existence of best management practices, regulatory compliance, etc., must all be eventually determined to complete a very accurate susceptibility analysis (discussed further in Chapter 4). As DHEC's resources for completing these assessments are limited, the PWS, local team, etc., may need to further refine the initial inventory.

3.5 Data Management

The data obtained from the inventory (name of facility, type of potential contaminants, latitude and longitude, etc.) and the assessments (protection area delineations and susceptibility information) will be managed using a Geographic Information System (GIS) maintained by DHEC. The inventories will be linked to other databases where possible so that data can be automatically updated. ESRI-USC produced a prototype contaminant inventory data management system using a GIS-based format. A web-based interface similar to this prototype will be developed to allow access to the information via computer and the Internet. This interface will eventually enable users (e.g., researchers, regulators, system operators, and the general public) to access data and the assessments pertaining to sources of drinking water for any portion of the state.

4.0
SUSCEPTIBILITY DETERMINATIONS

4.1 Introduction

The terms "vulnerability" and "susceptibility" are often used synonymously but, for the purpose of the SWAP, these have very distinct meanings. Vulnerability refers to the natural or intrinsic likelihood of contamination occurring due to a particular set of hydrogeologic conditions. For example, a shallow sand aquifer is naturally vulnerable to a rapid introduction of contaminants either released at the surface or underground. A deeper aquifer that is highly confined is by comparison much less vulnerable to contamination. Susceptibility combines vulnerability with the presence of potential contamination sources (PCS). If a vulnerable system has no significant PCS within the source area, it would not be considered susceptible.

Susceptibility assessments conducted in conformance with an approved state program will serve as the technical or legal basis for: federal and state funding priorities; granting monitoring relief, provided the assessments meet the requirements of the Alternative Monitoring Guidelines; and for subsequent protection measures adopted by state or local governing bodies. EPA is also considering the use of data collected in the assessment process: to assist in identifying high priority wells under the Groundwater Rule; as a basis for additional regulation of certain Class V wells within source water protection areas; and to assist in deciding whether to list impaired and threatened waters under the Clean Water Act.

South Carolina defines susceptibility as the potential for a Public Water System (as determined at the point immediately preceding treatment or, if no treatment is provided, at the entry point to the distribution system) to draw water contaminated at concentrations that would pose concern, through any of the following pathways: 1) geologic strata and overlying soil; 2) direct discharge, 3) overland flow, 4) upgradient water and 5) cracks/fissures, etc., in the physical well or surface water intake and/or the pipe between the well/intake and the water distribution system.

In simpler terms, South Carolina defines susceptibility as: ***The likelihood for the source water(s) of a public water system to be contaminated at concentrations that would pose a concern.***

The degree of susceptibility is, therefore, related to: 1) the physical integrity of the well/intake and the connection between the well/intake and the distribution system (up to the first form of treatment, if any); 2) the physical, chemical, geologic, hydrologic and biological characteristics of the area over which, or through which, the contaminant(s) will move; 3) the nature and amount of contaminant(s) present at the well/intake or in upgradient water; and 4) the nature and amount of contaminant(s) present in a source(s) and the likelihood of significant contaminant release from the source(s) based, in part, on the effectiveness of pollution prevention measures at the sites of potential source(s) of contamination.

The purpose of the susceptibility analysis is to: ***Provide information to a public water system as to what actions should be taken to reduce susceptibility.***

In recognizing that source water may enter a system at unintended locations, the well or intake is considered to include the conveyance to the distribution system (*i.e.*, to the "susceptibility determination point" in EPA's definition), particularly with regard to conveyances that are [a] open canals or aqueducts, [b] conspicuously subject to contamination (*e.g.*, running through agricultural areas), [c] more appropriately measured in miles than feet or [d] (for) which state of repair data is not readily available. The integrity of such conveyances is important because the susceptibility issues are likely to be the same as those for the source water upstream of the intake and because such analysis is mandatory, if it is going to serve as the basis for monitoring relief. For all intakes and conveyances, age and maintenance records can provide insights into current integrity.

A review of well integrity will include: the extent of surface water drainage toward the wellhead; casing integrity; joints between lengths of casing; grout between the casing and bore hole; grout in the annular spacing between casing springs from the bottom of each spring to the land surface; and the isolation of source water intake sequences, where the well draws from separate aquifer units. Maintaining the integrity of these features will provide reasonable assurance that contaminants will not enter the well through any pathway except the target aquifer(s), and allow systems to focus on the potential for contaminants to enter through the well intake points. However, even wells constructed to the most exacting standards may lose structural integrity with time, so a well's age and maintenance record also bear on an evaluation of its integrity.

A review of intake integrity will include any studies that were conducted on the site of the intake. Such studies may include susceptibility analysis, inspection and maintenance records for the intake structures and sanitary survey reports. There are analogous factors concerning the structural integrity of the conveyances from the wellhead or intake point to the distribution system. Under negative pressure conditions, cracks or loose joints can allow contaminated influent into the system downstream from the intake.

The likelihood that a contaminant would be released from a facility is related to the management of the facility and the nature of the contaminants generated, used or stored there *(e.g.*, their corrosivity). The key factors affecting the potential for release are whether the operation and maintenance practices at the facility include effective measures to prevent release, the age of the containment and transport structures, the number and type of barriers between the facility and the source water, and response measures should containment fail.

4.2 Groundwater Systems

The likelihood of a contaminant reaching a well is a function of whether the groundwater flows toward the well, the rate of flow, the distance to the well and the characteristics of the contaminant. The technical factors influencing this include: [1] the geologic, geochemical and physical characteristics, as well as the hydraulic and hydrochemical properties of the aquifer; [2] the direction,

slope and elevation of the potentiometric surface within the aquifer; [3] seasonal variations in the aquifer recharge rate; and [4] the nature and degree of groundwater/surface water interaction.

Deep source water will be less likely to become contaminated than a water table near the surface. A thick unsaturated zone, particularly an unsaturated zone with a thick soil sequence, may afford an aquifer some protection; a thin unsaturated zone typically provides less protection. Where data show, or circumstances indicate, that the surface water/groundwater interchange is significant, the combined surface water / groundwater resource should be considered as a unit. An aquifer may also be protected by a confining layer between the aquifer and the surface, although breaches in the confining layer or rapid transit from remote recharge areas working through subterranean conduits to the aquifer can reduce the level of protection. A few hydrogeologic settings are routinely considered to have a high vulnerability – karst, fractured bedrock, and surficial unconsolidated aquifers with shallow depth to water.

The vulnerability (based on natural conditions) of a drinking water supply well is based on its geographical location (which relates to the degree of confinement or natural protection). The vulnerability of an aquifer is the relative ease to which contaminants released at the surface (or shallow sub-surface such as an underground storage tank) can reach the aquifer. Using existing data, three main areas have been delineated which are characterized by high, moderate, and low vulnerability to contamination of aquifers and associated public water supply wells (Figure 12). For a public supply well to be susceptible to contamination, potential sources of contamination must be present in the groundwater capture zone. Therefore, the susceptibility of a public water supply well is a function of the natural vulnerability (based on the geographical location of the well as discussed above), the construction of the well (i.e., are there well construction deficiencies that may allow a contaminant to be introduced), and the physical/chemical characteristics (i.e., what is the expected fate and transport of the chemical once released into the environment) of the contaminants present in the groundwater capture zone. The susceptibility of each inventoried potential contamination source will be assessed as follows:

AREA 1 - HIGH VULNERABILITY GEOGRAPHIC AREA. Any source located in the groundwater capture zone, regardless of the type of contaminant or construction of the well, will be ranked as high in susceptibility.

AREA 2 - MODERATE VULNERABILITY GEOGRAPHIC AREA. A source located in the groundwater capture zone of the water supply well will be evaluated based on the well construction (pre-well construction regulations, post-well construction regulations) and the physical/chemical characteristic of the contaminants present.

- **Pre-well construction regulations -** the susceptibility of all sources will be high regardless of the physical/chemical characteristic of the contaminants present in the groundwater capture zone. This susceptibility degree may be reduced upon the submission of supporting data.

Three Major Areas of Aquifer Vulnerability

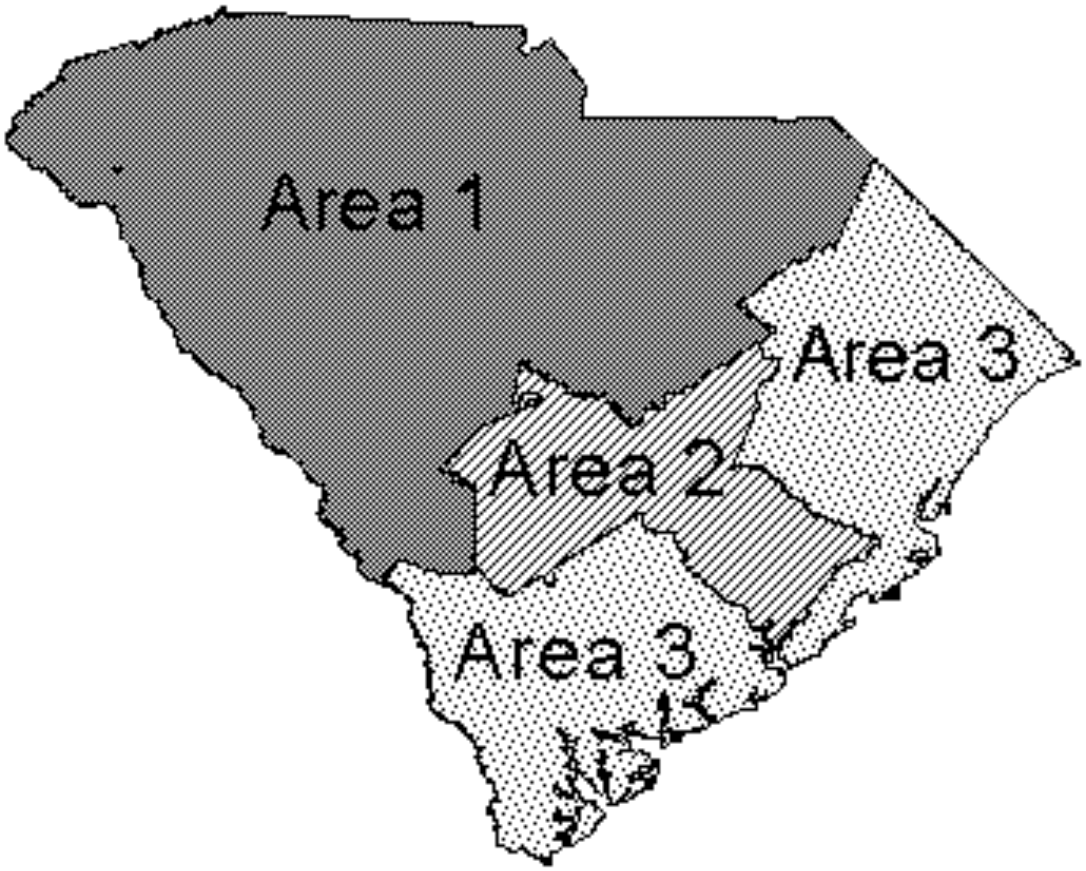


Figure 12

- **Post-well construction regulations** - the susceptibility of the water supply well will be evaluated based on the physical/chemical characteristic of the contaminants present as follows:

  CHLORINATED SOLVENTS (AND OTHER SELECT VOCs) - These chemicals are more dense than water and free-phase product can sink in an aquifer, and they are very mobile. The susceptibility of the well to such a source is high.

  PETROLEUM - These chemicals are less dense than water and degrade relatively easily. The susceptibility of the well to such a source is moderate.

  METALS - These chemicals sorb to the soil matrix and do not readily migrate vertically. The susceptibility of the well to such a source is moderate.

  PESTICIDES/HERBICIDES - These chemicals sorb to the soil matrix and do not readily migrate vertically. The susceptibility of the well to such a source is moderate.

  PATHOGENS - Pathogens are most likely introduced through poor well construction or where surface waters are pulled into the well. If neither condition is present, the susceptibility of the well to such a source will be low. If either condition is present, the susceptibility assigned will be high.

AREA 3 - LOW VULNERABILITY GEOGRAPHIC AREA. A source located in the groundwater capture zone of the water supply well will be evaluated based on the well construction (pre-well construction regulations, post-well construction regulations) and the physical/chemical characteristic of the contaminants present.

- **Pre-well construction regulations** -the susceptibility of all sources will automatically be moderate regardless of the physical/chemical characteristic of the contaminants present in the groundwater capture zone. This susceptibility degree may be reduced upon the submission of supporting data.

- **Post-well construction regulations** - the susceptibility of the water supply well will be evaluated based on the physical/chemical characteristic of the contaminants present as follows:

  CHLORINATED SOLVENTS (AND OTHER SELECT VOCs) - These chemicals are more dense than water and sink, and they are very mobile. The susceptibility of the well to such a source is moderate.

  PETROLEUM - These chemicals are less dense than water and degrade relatively easily. The susceptibility of the well to such a source is low.

METALS - These chemicals sorb to the soil matrix and do not readily migrate vertically. The susceptibility of the well to such a source is low.

PESTICIDES/HERBICIDES - These chemicals sorb to the soil matrix and do not readily migrate vertically. The susceptibility of the well to such a source is low.

PATHOGENS - Pathogens are most likely introduced through poor well construction or where surface waters are pulled into the well. If neither condition is present, the susceptibility of the well to such a source will be low. If either condition is present, the susceptibility assigned will be high.

4.3 Surface Water Systems

The quality of surface water reaching an intake can be jeopardized, or provided some degree of protection, by the natural hydrologic setting and by certain stream flow characteristics. There are a number of geochemical, hydrochemical and microbiological processes that can attenuate contaminant movement overland. Watersheds with bare slopes provide less filtration of pollutants in overland flow, less opportunity for infiltration, sorption, *etc.*, than slopes with lush vegetation. Steeper slopes reduce the time available for improving water quality by filtration. Watersheds predominantly composed of a bare or impermeable surface encourage rapid overland flow, whereas watersheds with highly permeable soils and lush vegetation are more likely to absorb runoff before it reaches a water supply.

4.3.1 Application of Susceptibility Zones

The three delineated Susceptibility Zones (see 2.2) are used as a general framework to rank the susceptibility of an intake to potential sources, regardless of the mode of contaminant transport. Each inventoried potential contamination source in an SWPA is assigned a low, moderate, or high susceptibility ranking in a susceptibility matrix based on the relative location and type of contaminant (Table 2). The three Susceptibility Zones and, in large SWPA's, the primary and secondary SWPA's, are used to locate the relative proximity of a potential source in a SWPA. Seven general categories of contaminants are considered in the susceptibility matrix: volatile organic compounds, radionuclides, undetermined, petroleum hydrocarbons, pesticides, metals, and pathogens. These categories "group" contaminants that tend to generally behave in a similar fashion once released in the environment. Chemical-specific fate and transport characteristics within each category are possible but for the first iteration of this process such detail may not be possible.

The undetermined category is established to assess potential sources such as highway and railroad bridges over the surface water flow system and boat ramps adjacent to streams and reservoirs. While these potential sources do not necessarily involve storage, use, or manufacture of a specific contaminant, the surface water flow system is susceptible to the direct discharge of contaminants from accidental transportation spills or illegal dumping at these types of structures. In addition, specific or potential contaminants are not necessarily associated with structures such as railways, highways,

borrow pits, and abandoned open-pit mines at off-stream sites in the SWPA; however, the undetermined category can be used for these and other structures that have a potential for illegal dumping or accidental spills of contaminants in the SWPA. If the contaminants from other types of potential sources, such as landfills, are not specifically known, the susceptibility ranking should be determined by using the undetermined contaminant category.

All potential contamination sources in Susceptibility Zone 1 (SZ1) are given a high susceptibility ranking in the primary SWPA because they are closer to the surface water system than those in Susceptibility Zones 2 and 3. The closer proximity of potential sources of contaminants in Susceptibility Zone 1 to the surface-water system minimizes the potential for attenuation of contaminants in overland flow and groundwater than in zones 2 and 3. In addition, contaminated sediment can be eroded from a potential source area and transported to the surface water flow system through overland flow.

Because Susceptibility Zone 2 is farther from the surface water flow system than Susceptibility Zone 1, the potential for contaminated water to reach the surface water flow system as overland flow and groundwater is less in zone 2 than in zone 1. This generalization about Susceptibility Zone 2 assumes that land-management practices and artificial drainage systems do not enhance the potential for overland flow across Susceptibility Zones 1 and 2. The reduced potential for overland flow minimizes the susceptibility of the system to pathogens, contaminated sediment, and dissolved and undissolved contaminants associated with overland flow. Groundwater flow paths from Susceptibility Zone 2 would be longer than those in Susceptibility Zone 1 which represent a greater potential for natural attenuation of the contaminants by dilution, adsorption, and biodegradation. Most pesticides and metals have a strong affinity for sorbing onto the soil matrix in the potential source areas. Although sorption immobilizes the bulk volume of metals and pesticides, the potential for some of these contaminants to reach the flow system in groundwater and overland flow cannot be ignored, particularly for metals under anaerobic conditions. Simulations of dissolved benzene plumes indicated that petroleum hydrocarbons from potential sources in Susceptibility Zone 2 could reach the surface water flow system by way of groundwater flow paths under flow conditions that are typical for South Carolina aquifers. Therefore, potential sources in Susceptibility Zone 2 are given moderate susceptibility rankings for petroleum hydrocarbons, pesticides, and metals. To account for greater mobility of pathogens, susceptibility rankings will be high in Susceptibility Zones 1 and 2 and moderate in Susceptibility Zone 3.

Potential sources of volatile organic compounds (VOC's), particularly halogenated solvents such as TCE, are assigned high susceptibility rankings in Susceptibility Zone 2, because VOC's do not readily degrade and are mobile in aerobic groundwater. Because of their persistence in the environment, potential sources of radionuclides with low decay rates also are assigned high susceptibility rankings, although the rapid decay of some radioactive isotopes relative to groundwater travel time needs to be considered. Potential sources of undetermined contaminants are assigned high susceptibility rankings because of the uncertainty associated with the unknown behavior of these potential sources.

All contaminants in Susceptibility Zone 3 are assigned low susceptibility rankings, except volatile

organic compounds, pathogens, radionuclides, and undetermined contaminants. Once again the lower rates of degradation of many halogenated compounds in the volatile organic compound category make them a potential threat to the surface water flow system, regardless of location in the SWPA; however, the potential for attenuation of a groundwater contaminant is greater in Susceptibility Zone 3 than in Susceptibility Zones 1 and 2 because of the distance between Susceptibility Zone 3 and the surface-water flow system. Therefore, potential sources of VOC's in Susceptibility Zone 3 are assigned moderate susceptibility rankings. Potential sources of radionuclides also are assigned moderate susceptibility rankings because of their potential for persistence in the environment. Potential sources of undetermined contaminants also are assigned moderate susceptibility rankings.

If a potential source is located in more than one Susceptibility Zone, the susceptibility ranking is based on the nearest Susceptibility Zone to the surface water flow system. For example, if pesticides are applied to an extensive field of corn in Susceptibility Zone 1 and 2 in a primary SWPA, the field is treated as one potential source of the pesticides and is assigned the high susceptibility ranking for Susceptibility Zone 1 in a primary SWPA.

If a SWPA is large enough to have a secondary SWPA, the three Susceptibility Zones are applied to the surface-water flow system in the secondary SWPA, as in the primary SWPA. Contaminants from potential sources in the secondary basin have a longer travel time through the surface water system to reach the intake, relative to contaminants from potential sources in the primary basin. The additional travel time represents a greater potential for attenuation of contaminants by dilution, adsorption, and degradation. For this reason, potential contaminant sources that would be assigned high and moderate susceptibility rankings in the primary SWPA are assigned moderate and low susceptibility rankings, respectively, in the secondary SWPA.

4.3.2 Susceptibility Analyses

By using the location of an identified potential contamination source within the three Susceptibility Zones and type of contaminant present (classified within the contaminant categories), a base-line or Level 1 susceptibility analysis will be completed for all wells and intakes. Additional data may be available (or may become available), particularly GIS data layers, that can supplement this basic evaluation during the Level 1 susceptibility analysis. This additional data will be used to the extent practical. For example, a general land-use data "layer" is available that, when overlain on the base delineation and Susceptibility Zones, may provide additional information useful in the assessment or protection activities. Also, areas within the basin where high slopes and clayey soils exist (which enhance the potential for overland flow of non-point associated contaminants) will be identified using the available GIS data layer. An agricultural potential contamination source located on this type of soil and slope would be given a higher susceptibility rating even if located in SZ3.

To refine the initial Level 1 susceptibility analysis, a Level 2 analysis will be necessary. This analysis will include determining the volume of the contaminant used or stored at an identified potential contamination source, existence or lack of best management practices, regulatory compliance history, and operational status. For example, a potential source located in SZ2 that was initially given a

moderate susceptibility ranking during Level 1 could be given a very high ranking (e.g., large volumes of material used, history of past releases, etc.) or be given a low ranking (only a small volume of material in a double walled container) as a result of the Level 2 analysis. As this information is not currently available on existing databases for every potential source, the Level 2 analysis will require a site visit and site-specific evaluation. The Level 2 analysis will be completed by DHEC if time and monies allow. If this cannot be accomplished within existing resource limitations, DHEC will work with local governments and system operators to complete the Level 2 analysis at the local level.

A Level 3 analysis is also envisioned that would involve further refinement of susceptibility by evaluating chemical-specific fate and transport. Level 3 certainly cannot be completed at this time, but should be an ultimate goal.

Public water systems that wish to augment the basic assessment provided by DHEC will have the flexibility (and are encouraged) to do so.

5.0
IMPLEMENTATION

5.1 Assessment Schedule

DHEC will request the 18 month extension allowed under the 1996 Amendments to the SDWA in order to fully implement this plan. Therefore, DHEC will complete the required assessments for all public water systems within 42 months of EPA approval of the plan. In general, DHEC plans to start with the larger community water systems. This will allow systems serving the greatest percentage of the population to be assessed first. To be successful and cost effective, a certain degree of flexibility will be built into the scheduling process. Systems that have a priority need, e.g., impaired drinking water, may move ahead in the schedule. Also, scheduling data collection on a regional basis may be more cost effective. System operators will be contacted prior to initiation of the assessment so that they can participate in the process.

5.2 Assessment Results

A report for each public water system will be generated. This report will include a narrative explaining the results of the assessment, one or more maps illustrating the delineated source water protection area along with locations of potential contamination sources, and a table listing the inventoried potential contamination sources with the associated susceptibility analysis.

Upon completion of the assessment, a draft copy of the report will be given to the public water system for review at least two weeks prior to public release so that any omissions or errors can be corrected. Once final, the report will be released to the public by posting on the DHEC Internet Homepage and through a news release to the local media. The public will be able to view the report at the homepage, local DHEC District Environmental Quality Control office, DHEC District Health Department, and at the public water system office.

For the larger systems, the results of the source water assessment will be announced by the public water system through their annual Consumer Confidence Report that will be mailed to each customer.

5.3 Achieving a Voluntary Source Water Protection Program

Protection activities are not a mandated element of the 1996 SDWA Amendments. However, implementation of local protection activities is the goal of DHEC so that the information gained by the assessments can be of benefit to the public. DHEC plans to work with the public water system, local governments, environmental organizations, and the general public to implement a local protection program. Based on local protection goals, protection activities may vary from insuring best management practices to zoning certain activities deemed hazardous to the water supply. DHEC staff will provide technical assistance so that communities may be able to achieve source water protection by:

- Establishing a local source water protection team;
- Reviewing and continually updating the initial source water assessment prepared by DHEC; The following may be needed:
  - Gather additional site-specific hydrogeologic and other relevant data;
  - Refine the initial susceptibility analysis based on site-specific data;
  - Refine and update the potential contamination source inventory.
- Review susceptibility analysis and prioritize protection activities;
- Conduct contingency planning.

Each source water protection program will need to be tailored to the needs of the community, the level of land-use authority available, and the amount of citizen support. Educating residents and businesses on pollution prevention within the delineated source areas is a critical component. DHEC will promote and support the development of local source water protection programs through technical assistance, training, education, and demonstration projects.

5.4 Bordering States

South Carolina is bordered by Georgia and North Carolina. A few watersheds and/or wellhead protection areas will cross state boundaries. DHEC will share information gained from these assessments with other interested states and expects full cooperation with the exchange of information from our neighboring states. Therefore, DHEC does not expect a formal agreement with our bordering states to be necessary to complete assessments that cross state lines.

5.5 Protection for New Water Systems

The delineation of wellhead protection areas and contamination inventory for newly permitted public supply wells is required. The permitting process is outlined in Appendix E. A similar process will be implemented for surface water intakes.

5.6 Monitoring Waivers

Based on the results of the assessments, DHEC will pursue monitoring waivers where possible.

5.7 Funding Source Water Assessments

DHEC is using the one-time FY97 Drinking Water State Revolving Loan Fund source water assessment set-aside to perform the required assessments.

5.8 Progress Reports to EPA

DHEC will incorporate reporting the status of source water assessments with the biennial reporting of WHP Program status to EPA.

REFERENCES CITED

Lanier, T.H., and Falls, W.F., 1998, Methods for segmenting source-water protection areas and assessment of susceptibility to contamination for public surface-water systems, South Carolina: United States Geological Survey Report, 49p.

Rine, J.M, Covington, E.R., and Atkins, J.B., 1998, Contaminant inventory methodology for the source water assessment and protection program in South Carolina, Technical Report 98-10.1-F140: Earth Sciences and Resources Institute at the University of South Carolina, 10p.

South Carolina Department of Health and Environmental Control, 1997, Wellhead protection program: technical guidance for local groundwater protection in South Carolina, DHEC, 62p.

United States Environmental Protection Agency, 1997, State Source water assessment and protection program guidance, EPA 816-R-97-009.

TABLES

Table 1 - GROUNDWATER SUSCEPTIBILITY

GENERAL CONTAMINANTS FOR PRE-CONSTRUCTION REGULATIONS	AREA 1	AREA 2	AREA 3
VOC - Chlorinated Solvents	HS	HS	HS
Petroleum	HS	HS	HS
Metals	HS	HS	HS
Pesticides/Herbicides	HS	HS	HS
Pathogens	HS	HS	HS
Undetermined	HS	HS	HS
GENERAL CONTAMINANTS FOR POST-CONSTRUCTION REGULATIONS	AREA 1	AREA 2	AREA 3
VOC - Chlorinated Solvents	HS	MS	MS
Petroleum	HS	LS	LS
Metals	HS	LS	LS
Pesticides/Herbicides	HS	LS	LS
Pathogens	HS	LS	LS
Undetermined	HS	MS	MS

Key: HS - High Potential Susceptibility
MS -Moderate Potential Susceptibility
LS - Low Potential Susceptibility

Table 2 - SURFACE WATER SUSCEPTIBILITY

GENERAL CONTAMINANTS FOR PRIMARY SOURCE-WATER AREA	ZONE 1	ZONE 2	ZONE 3
VOC - Chlorinated Solvents	HS	HS	MS
Petroleum	HS	MS	LS
Metals	HS	MS	LS
Pesticides/Herbicides	HS	MS	LS
Radionuclides	HS	HS	MS
Pathogens	HS	HS	MS
Undetermined	HS	HS	MS
GENERAL CONTAMINANTS FOR SECONDARY SOURCE-WATER AREA	ZONE 1	ZONE 2	ZONE 3
VOC - Chlorinated Solvents	MS	MS	LS
Petroleum	MS	LS	LS
Metals	MS	LS	LS
Pesticides/Herbicides	MS	LS	LS
Radionuclides	MS	MS	LS
Pathogens	MS	MS	LS
Undetermined	MS	MS	LS

Key: HS - High Potential Susceptibility
MS -Moderate Potential Susceptibility
LS - Low Potential Susceptibility

APPENDIX A
PUBLIC PARTICIPATION

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The 1998 Source Water Assessment and Protection Public Forums

Why Do a Source Water Assessment?

The 1996 amendments to the Safe Drinking Water Act require that each State establish and implement a Source Water Assessment Program (SWAP) for the protection and benefit of drinking water sources throughout the United States. States will use information gained from SWAPs to assess threats to drinking water sources so that citizens, local communities, and public water system operators will have enough information to take proactive, preventative actions concerning protection of their drinking water sources.

What is a Source Water Assessment?

There are Three Major Components:

Delineation of Source Water Protection Area - Defining the land area which contributes water to a surface or groundwater drinking water source.

Contaminant Inventory - Locating and identifying the land uses and activities within the source water protection area that could potentially release contaminants to the source water.

Susceptibility Analysis - Evaluation of the contaminant inventory to determine the relative potential of a contaminant reaching a source water intake in an amount that would adversely impact drinking water quality.

Who is Invited?

Everyone! Any person concerned about their drinking water is encouraged to attend and participate in the plan development process.

What Will be Discussed?

Forum discussion will include an overview of requirements for an adequate Source Water Assessment Program (SWAP) and a review of proposed strategies for development of SC's assessment plan. Meeting locations and dates are listed below.

All Meetings Start at 6:30pm

- **Columbia DHEC Office (Columbia) - Wednesday, August 5**
  2600 Bull Street, Peeples Auditorium
- **Aiken DHEC Office (Aiken) - Thursday, August 6**
  206 Beaufort Street NE, Main Meeting Rm.
- **Florence/Darlington Tech. Coll. (Florence) - Wednesday, August 12**
  US Route 52 North, Bldg. 7000, Rm. 7104
- **Greenville Technical College (Greenville) - Thursday, August 13**
  291 S. Pleasantburg Drive, Industrial C, Rm. 513
- **York Technical College (Rock Hill) - Wednesday, August 19**
  452 S. Anderson Road, Bldg. A, Rm. 256
- **Trident Technical College (N. Charleston) - Thursday, August 20**
  7000 Rivers Ave., Bldg. 100, Rm 169
- **Tech. Coll. of the Low Country (Beaufort) - Wednesday, August 26**
  Ribaut Road, Auditorium
- **Horry/Georgetown Technical Coll. (Conway) - Thursday, August 27**
  Hwy. 501, Bldg. 700, Rm. 707

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PUBLIC FORUMS

The following section presents questions and comments posed by forum attendees (in bold) and responses to those questions. The cities in which the comments were made are listed after each comment.

Attendees from several of the meetings felt that the proposed protection area distances for surface water bodies were too narrow, or too wide, and were selected arbitrarily. (Columbia, Aiken, Florence, Greenville, Rock Hill, Beaufort)

The USGS used studies by both the United States Forest Service and the Natural Resources Conservation Service to obtain the 200-foot overland flow distance protection area. USGS also ran an EPA model of contaminants and groundwater flow many times to determine the 1500-foot groundwater flow protection distance around surface water areas. The rationale and justification for the proposed distances are discussed in detail in the Plan.

What will happen in areas where known potential contaminants exist within a buffer zone or protection area? (Rock Hill)

A Source Water Assessment will allow just such a situation to be identified and offer opportunity for the water system operator, community members, and potential contaminant owner to address the situation through their community protection plan. Outcome may vary from a general understanding of a need for tighter safety controls to aid in contaminant containment to the incorporation of zoning laws.

The delineation methods for protection areas apply to some or most situations, but not all. (Columbia)

Neither resources nor the mandated time schedule allow developing an individual model of delineation for each surface water intake. However, the proposed methods were meant to apply in a variety of situations. They were acquired through scientific methods and have been researched by USGS.

Groundwater source delineations are based on EPA-approved Wellhead Protection Program delineation methods.

How will South Carolina handle shared watershed areas such as the Savannah or zoned areas of concern that extend into another authority? (Aiken, Greenville, Rock Hill, Charleston, Beaufort)

South Carolina is preparing a work plan for an EPA grant to coordinate with Georgia. If the other authority is another state, all states are required to prepare a SWAP. If the other authority is another county in the same state, local governments will need to work towards an agreeable solution.

What is a HUC Code? (Greenville)

HUC is an acronym for Hydrologic Unit Code. HUC codes are numerical designations that the USGS has assigned to each individual surface water drainage area throughout the nation.

Has existing groundwater contamination been documented in South Carolina? (Charleston)

Yes. DHEC staff are working on clean-up of approximately 4000 sites. However, less than 1% of available groundwater in the state is contaminated.

What are the most common contaminants in the water? (Rock Hill)

Petroleum constituents from leaking underground storage tanks are the most common contaminants in groundwater; bacteria is the most common contaminant in surface water.

How will complex pollutants in databases be handled? (Beaufort)

Much data already exists in established databases. Resources are needed to acquire and assemble the various databases into a SWAP database.

Do Global Information System (GIS) maps show documented contaminant releases or do they show where potential contaminants are located? (Beaufort)

Both known cases of contamination and potential sources are shown on the maps where that information is available. For instance all underground storage tank (UST) locations have not yet been mapped, but all known UST releases soon will be.

How will information on movement of a release be tracked through a watershed? (Aiken)

Groundwater releases are managed on a site-by-site basis by assessing the extent of the release and remediating the release to limit the distance traveled by the contaminant. Surface water releases engage emergency response processes that evoke a plan of action unique to the site and type of release. A community Source Water Protection Plan will aid in determining the source of a release and in determining the plan of corrective action.

Is organic farming considered when basing pesticide use on crop data? Do the crop data records extend back in time? It is possible that chemicals could be present in areas where farms had been located but now are no longer in existence? (Aiken, Rock Hill)

The inventorying of pesticides is based on crop data. To be conservative, it is assumed that pesticides and herbicides are used in all crop areas.

Historic crop data exists, but is incomplete. Land use can and does change, local information should be used to optimize the assessment.

Why not use seed sales information for possible crop data? (Rock Hill)

Sales information is not considered accurate for point of use because purchases are recorded at the point of sale but the seeds can be applied in another area. For example: Buy seeds in Richland County and plant them in Lexington County.

Agricultural data changes constantly; will the databases be maintained? (Rock Hill, Beaufort)

Databases must be kept current to be useful. It is anticipated that databases from different programs will eventually be integrated.

Will the concentrated animal feeding operations and nitrogen and phosphorus data be included? (Rock Hill)

As it becomes available it will be included, but nitrogen and phosphorus are not in digital form.

How will urban areas and nonpoint source pollutants be tracked? (Beaufort)

This is still being evaluated in the pilot studies; the land-use database from the Department of Commerce may be used.

There are concerns about atmospheric contributions to surface water and surface water contamination contributing to air. (Florence, Rock Hill)

Although active research is being conducted on the effects of acid rain, the effects of other atmospheric constituents to water are not well known. However, contaminants dissolved within water generally do not evaporate into the atmosphere.

Cemeteries, suspended solids and timber should be added to the contaminant list. (Greenville)

The above mentioned potential contaminant sources will be included in the inventory.

Existing data from other programs should be used for assessments. (Charleston)

A consistent message delivered by the guidance issued from EPA was to avoid duplication of effort and use existing data where available. Every effort is being made

to avoid duplication.

Section 303d of the Clean Water Act already has identified impaired waters - why do SWAP? (Rock Hill)

It is a goal of the SWAP to link with existing programs. 303d data will be used during assessments of the drinking water sources. Also, SWP will allow for proactive protection of drinking water source areas that, although not identified as impaired, may have existing potential sources of contamination within their protection area.

How does SWAP fit into The Clean Water Act, Section 319 (nonpoint source) etc.? (Rock Hill)

SWAP is a subset of watershed management. All of these areas are housed in DHEC's Bureau of Water, therefore simplifying communication between program areas.

Is there a relationship between the SWAP and other DHEC program areas? (Aiken)

SWAP data will be considered during Comprehensive Environmental Response Compensation and Liability (CERCLA) ranking. SWAP will also be incorporated into drinking water permitting.

Identifying a well or intake as being highly susceptible to a potential source may be too threatening to the public. (Columbia)

The intent of assigning various levels of susceptibility of the intake to potential sources is to inform, not alarm, the public. It is necessary to rank the sources so that proper management can be achieved.

Increased notification of meetings to the public; information should be included in the water bill; will assessments be available on the Internet and will there be a tutorial for the website? (Columbia, Aiken)

Keeping the public informed of the status of assessments and making the assessments easily available to the public is recognized as one of the most important aspects of this program. The assessments may be too large to be included within an individual water bill, however some information to notify the public of the program can be achieved using this process. Information collected will be located at easily accessible places and on the Internet. The website will have a tutorial.

Does the SWAP contain provisions for any new enforcement? (Rock Hill, Beaufort)

No, but if a violation is found during the assessment, existing enforcement authorities would be utilized.

Will SWAP be prioritized based on known impacted areas? (Rock Hill)

It is recognized that priorities need to be established, but this has not been defined yet.

When will the assessment be completed? (Rock Hill)
May 2003, which is 3 ½ years from date of EPA formal approval of the plan which should occur in November 1999.

Will there be on-going results beyond assessments; i.e., what will be done with this information and where do prevention activities fit in? (Rock Hill, Beaufort)

Implementation of the SWAP process is not mandated in the statute, nor is it funded. It is hoped that public water systems, environmental groups, local governments, citizens, etc., will use these assessments to make local decisions about location management of businesses and industry. DHEC cannot currently impose zoning from the state level to local levels.

A public water system on a stream needs immediate notification of a spill. (Aiken)

Having an assessment and protection plan can help in this situation. There should be an emergency notification process in place.

Who will conduct the assessments? (Greenville)

The state will conduct the assessments with public water system operator involvement.

Is Source Water Protection driven by the local community? (Aiken)

The assessments will be completed by the State in conjunction with the water operators and community members. However, implementation of a protection plan must be carried out by the local community.

A wide range of situations from one system and area to another exists - flexibility is needed; how will small systems be affected? (Aiken, Rock Hill, Charleston)

The proposed assessment methodologies can be considered minimum requirements established to maximize effort based on time and money. However, local entities can implement protective measures for the program to work. Large facilities may be able

to help with or expand their assessments. The limited resources of small systems is understood.

The Savannah River Site affects both groundwater and surface water discharging to the Savannah River; the effect to the intake for the Beaufort-Jasper Water and Sewer Authority intake needs to be determined during the SWAP process. (Beaufort)

This is a complex and problematic basin area. This is the type of problem that it is hoped a SWAP program can detect and be used as a tool to aid in working towards a solution for the area. These types of special situations are another reason it is advisable to have the water operator or community representative active in the assessment process.

Does every watershed already have an analysis? (Beaufort)

Pilot studies are being conducted for three systems. These areas were chosen as they represent the varying hydrologic conditions in the state. Once the SWAP is approved through EPA, DHEC will begin to complete an analysis of each federally-defined (more than 15 taps and serving more than 25 people per day) water system in the State.

Does the SWAP process apply to federal facilities such as Air Force Bases, etc.? (Beaufort)

The requirements are the same for both federal and non-federal facilities.

The over-pumping of the Floridan aquifer should be addressed by the SWAP process; protect the resource's quantity in addition to quality (salt water intrusion). (Beaufort)

This concern is currently being addressed through DHEC's Capacity Use Program and through negotiations with Georgia.

Lake Wylie is the most eutrophic lake in state - nutrient levels must be measured and included. (Rock Hill)

These levels are being measured.

Anderson residents were concerned about WWTP discharges and Big Creek Landfill discharging into Saluda above Belton-Honea Path drinking water intake. (Greenville)

These situations will be evaluated using SWAP methods to determine the risk that they pose.

In some areas, the local power company restricts stream flow or other factors limit the quantity of water; when volume is down the concentrations of contaminants increase. (Columbia, Florence)

Public water supplies are routinely monitored for potential harmful contaminants. If a problem is identified, it is addressed by DHEC.

Review waste load allocations to correct for low flow, multiple sources, and discharges. (Florence)

Total Maximum Daily Loads (TMDLs) are being developed to address these variables.

Are Public Water Systems required to maintain sufficient quantities of water? (Columbia)

The regulations require that systems maintain certain pressures within the system lines.

A regional landfill should not be permitted. (Greenville)

One of the purposes of the SWAP is to determine the effects of siting landfills and other facilities in the watershed and near sources of drinking water. As stated above, it is anticipated that SWAs will be used to aid in permitting decisions.

Will the DHEC Board implement state-wide land-use planning? (Rock Hill)

That is uncertain at this time.

Why doesn't DHEC require zoning? (Greenville)

DHEC does not have the statutory authority to direct local zoning: this authority rests with local governments.

Source Water Assessment Plan Advisory Committee Minutes

SCDHEC, Columbia, SC, December 2, 1997, from noon until 2PM

At noon the Safe Drinking Water Act Implementation Advisory Committee was joined by members of the Source Water Assessment Plan Advisory Committee for their initial meeting.

David Baize began his presentation of the Source Water Assessment Program by describing the three main steps required:

1: Delineation
2: Contaminant Inventory
3: Susceptibility Analysis

Then the elements which are required for the SWAP were discussed:

1: Public Participation
2: Assessment Approach
3: Public notification of the assessment results
4: Implementation of the SWAP approach selected

The committee members were then asked whether they felt that the composition of the committee was appropriate and whether people representing other groups needed to be added. It was suggested that the SC Service Station Dealers Association be represented.

SCDHEC will coordinate the mailing and faxing of draft plans and other information to facilitate the committee's input while minimizing travel and time expenditures.

For ground-water sources of public water supply, the EPA-approved Wellhead Protection Program methods will be utilized.

Technical elements not yet in place:

1: For surface water sources, the methodologies are being developed.
2: Criteria for including contaminant sources on the inventory need to be refined.
3: Susceptibility analyses criteria need to be developed.

Tentative Schedule:

Dec 97 - Mar 98	develop draft plan
Mar/Apr 98	meet to discuss draft plan
Apr/Aug 98	conduct workshops across the state

Aug 98 meet to discuss changes resulting from public comment

It was suggested that surface water intakes be emphasized as the majority of the population is served by surface water public supply.

It was agreed that existing available data from agencies such as USGS, Department of Natural Resources and Department of Commerce be used to ensure that duplication of effort is minimized.

Issues:

What to do with a facility already operating within a subsequently delineated protection area?

What approach should taken for watersheds that originate in another state (Catawba, Great Pee Dee) and shared watersheds (Savannah).

Source Water Assessment Plan Advisory Committee Minutes

SCDHEC, Columbia, SC, May 14, 1998, from 11AM until 1PM

At 11AM the Safe Drinking Water Act Implementation Advisory Committee was joined by members of the Source Water Assessment Plan Advisory Committee for their second meeting.

David Baize began by informing the committee that the EPA had verbally approved the composition of the committee and an approval letter was forthcoming.

He also noted that we were preparing a proposal in conjunction with Georgia for both states to cooperate in the Source Water Assessments in the Savannah River Watershed, which is shared by both states. North Carolina's environmental programs are undergoing a reorganization; discussions on cross-boundary watersheds will be held when the reorganization is completed.

Mr. Baize mentioned the recent nationwide meeting in Dallas, Source Water Assessment and Protection 98. He indicated that most states are still developing methodologies for delineation, contaminant inventory, and susceptibility analysis.

The pilot studies were then briefly described. The study areas were selected to represent varied surface water hydrological conditions. The City of Aiken intake at Shaw Creek represents a Coastal Plain example; the Belton-Honea Path intake in the Saluda River is a Piedmont example; and Greenwood CPW's intake is in Lake Greenwood. In the pilot studies, the different pathways for contaminants to reach the intakes are to be examined: instream, groundwater and overland flow. A Zone of Concern (ZOC) is to be identified for each pathway.

Tim Lanier of the USGS presented the proposed approach to calculate the time-of-travel in a stream. Velocity measurements from dye studies were compared to calculated time of travel from a number of Jobson's equations in both the Coastal Plain and Piedmont. A reasonable fit was achieved for each geologic province; Jobson's equation 12 for the Piedmont and equation 14 for the Coastal Plain. For the

overland flow ZOC, it was proposed to delineate the flood plain plus 200 feet on both sides of the stream. The entire surface of the lake plus a 24-hour TOT upstream was proposed for the lake ZOC.

Fred Falls of the USGS presented the groundwater ZOC. BIOSCREEN was used to calculate distances that plumes of various concentrations of benzene and toluene would travel before natural attenuation renders them non-detectable. Under most conditions, benzene plumes would not reach 1500 feet; however, toluene generally exceeded that.

Jim Rine of the Earth Sciences and Resources Institute (ESRI) at USC discussed the availability of databases that may be used for the inventories. SCDHEC provided GIS coverages of public water systems, NPDES discharge points, known groundwater contamination cases, RCRA TSDs, etc. Land use maps can also be employed, but data gaps do exist. For example, at this time only the UST sites with a confirmed release of petroleum products are being located by GPS, rather than all permitted UST sites.

Buddy Atkins of ESRI noted that only .23% of the Shaw Creek watershed is urban; therefore, urban run-off is of low concern. He explained that some crop data are available and may be used to target certain pesticide, herbicide, and fertilizer contaminants.

In discussing susceptibility, Fred Falls presented a table of potential sources plotted against their proximity to the intake. An approach like this may be useful for determining which sources pose the most risk in a watershed and whether certain watersheds are more at risk than others.

The committee was then presented the proposed public meeting places. Public meeting are to be held in the following cities: Myrtle Beach, Charleston, Beaufort, Florence, Columbia, Aiken and Spartanburg. These will be evening meetings held in the local Technical College auditoriums. Final dates, times, and agendas will be made available when finalized.

The meeting concluded with a listing of the next steps:

The pilot studies are to be finalized.
SCDHEC's internal SWAP team will review the studies.
The results are to be presented to the Advisory Committee at the July 16 meeting.
The public meetings will be held in August.

Source Water Assessment Plan Advisory Committee Minutes

SCDHEC, Columbia, SC, January 20, 1999, from 1:30 PM until 3:00 PM

At 1:30 PM the Safe Drinking Water Act Implementation Advisory Committee was joined by members of the Source Water Assessment Plan Advisory Committee for their third meeting.

As this was the first meeting for some committee members, David Baize began by presenting a brief overview of SC's SWAP.

Advisory Committee Comments:

Some contaminants varied from high to moderate to high susceptibility on Table 1. *After some discussion, SCDHEC agreed that susceptibility should be high for all contaminant classes in wells installed prior to construction regulations.*

Clarification on whether SCDHEC or the PWS was going to conduct the activity should be provided. *This was intentionally left flexible in the event that the utility wanted to do its own assessment; however, SCDHEC agreed that the text will be changed to indicate that SCDHEC intends to complete the delineation unless the PWS intends to. Contracting with consulting firms for the inventories or delineations is also being considered.*

Upon completion of the assessment, all maps and reports should be provided to the PWS at least two weeks before being made public. *The committee noted that assessments will subject to FOI requests when completed, but agreed that it was reasonable to put the assessment on the SCDHEC web site two weeks after the PWS had reviewed it.*

Can the Susceptibility Zone 1 or 2 boundary be re-drawn to incorporate a facility which poses a notably significant threat? *SCDHEC decided that the boundary should remain in place, but the susceptibility ranking can be increased.*

Conducting a detailed inventory within only Susceptibility Zones 1 and 2 does not provide the susceptibility information necessary to implement protection strategies; every potential contamination source within the watershed can be inventoried using databases with its distance to the stream or water body calculated by GIS and used in the weighting of the susceptibility ranking. *SCDHEC recognizes that inventorying every potential source is a worthy goal; however, the Shaw Creek pilot study demonstrated that many potential sources are not listed on databases. Conducting a 'windshield survey' statewide may not feasible given the time and resources allocated. One of the EPA's primary factors evaluated in approving a state's Plan is that it is achievable.*

Using a 24-hour in stream time-of-travel to separate primary susceptibility from secondary does not provide adequate protection to the PWS intake. *SCDHEC noted that hourly times-of-travel were indicated on the pilot study maps and, as in the Susceptibility Zone response above, the susceptibility ranking can be increased.*

Using a 200-foot buffer zone is arbitrary. If the stream side is forested, a smaller buffer would suffice; if the stream side is paved, a much larger buffer distance. *As SCDHEC noted in prior responses to this comment, Susceptibility Zone 1 is not a riparian buffer, it is an area in which a potential contaminant sources clearly poses more risk.*

The question of time and labor necessary to conduct windshield surveys arose. *The committee was informed that the survey took about two days for the Shaw Creek pilot study and a member of the committee indicated that the survey for Wellhead Protection Program purposes for the Town of Timmonsville also took about two days.*

Will SCDHEC wait for EPA approval of the plan to proceed with the assessments? *The committee was informed that SCDHEC is currently proceeding with Wellhead Protection delineations as that program has EPA approval.*

Will SCDHEC incur any sanctions from the EPA because the final SWAP Plan will not be submitted by February 6, 1999? *No - EPA has been provided the same draft version as the committee reviewed to meet this deadline.*

Implementation of the plan will be difficult because watersheds cross county and state lines. *It was agreed that this will be the most challenging part of the program.*

The committee agreed that, with the changes noted above, the plan can be provided to the public for comment.

A workplan and grant application for the Savannah Shared Watershed Project with Georgia was submitted to the EPA in November of 1998. EPA Region 4 staff are checking on the status for approval.

APPENDIX B
CONTAMINANTS OF CONCERN

POTENTIAL DRINKING WATER CONTAMINANTS

Contaminant Name	MCL / HAL [1]	MCLG [2]	Source	
NATIONAL PRIMARY DRINKING WATER CONTAMINANTS				
INORGANIC CONTAMINANTS				
Antimony	0.006	0.006	**Commercial / Industrial**	Electrical / Electronic Manufacturing, Metal Plating / Finishing / Fabricating, Synthetics / Plastics Production
Arsenic	0.05	None	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Photo Processing / Printing, RV / Mini Storage, Research Laboratories, Retail Operations, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Golf Courses and Parks, Landfills / Dumps, Public Buildings and Civic Organizations, Schools, Utility Stations
Asbestos	7M fibers / L	7M fibers / L	**Commercial / Industrial**	Construction / Demolition
Barium	2	2	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Cement / Concrete Plants, Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Office Building / Complex, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetics / Plastics Production, Underground Storage Tanks, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Landfills / Dumps, Public Buildings and Civic Organizations, RV / Mini Storage, Schools, Utility Stations
Beryllium Powder	0.004	0.004	**Commercial / Industrial**	Research Laboratories
			Residential / Municipal	Public Buildings and Civic Organizations, Schools
Cadmium	0.005	0.005	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Boat Repair / Refinishing, Chemical / Petroleum Processing, Construction / Demolition, Drinking Water Treatment, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Military Installations, Office Building / Complex, Photo Processing / Printing, Medical / Vet Offices, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Underground Storage Tanks Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Landfills / Dumps, Public Buildings and Civic Organizations, Schools, Utility Stations, Wastewater
Chromium	0.1	0.1	**Commercial / Industrial**	Metal Plating / Finishing / Fabricating
Copper	TT[3]	1.3	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
Cyanide	0.2	0.2	**Commercial / Industrial**	Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers
			Residential / Municipal	Drinking Water Treatment, Public Buildings and Civic Organizations, Schools, RV / Mini Storage, Utility Stations
Fluoride	4	4	**Commercial / Industrial**	Construction / Demolition

Contaminant Name	MCL / HAL [1]	MCLG [2]	Source	
Lead	TT	0.015	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Boat Repair / Refinishing, Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Mines / Gravel Pits, Office Building / Complex Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Underground Storage Tanks, Wholesale Distribution Activities, Wood Preserving / Treating, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Drinking Water Treatment, Golf Courses and Parks, Landfills / Dumps, Public Buildings and Civic Organizations, Schools, Utility Stations, Wastewater
Mercury	0.002	0.002	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Boat Repair / Refinishing, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Office Building / Complex, Photo Processing / Printing, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Landfills / Dumps, Public Buildings and Civic Organizations, RV / Mini Storage, Schools, Utility Stations, Wastewater
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
Nitrate	10	10	**Commercial / Industrial**	Boat Repair / Refinishing, Historic Waste Dumps / Landfills
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Landfills / Dumps, Septic Systems Waste Transfer / Recycling, Wastewater
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Crops - Irrigated + Non-irrigated, Lagoons and Liquid Waste, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Nitrite	1	1	**Commercial / Industrial**	Boat Repair / Refinishing, Historic Waste Dumps / Landfills
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Landfills / Dumps, Septic Systems, Waste Transfer / Recycling, Wastewater
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Lagoons and Liquid Waste, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads, Crops - Irrigated + Non-irrigated
Selenium	0.05	0.05	**Commercial / Industrial**	Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Furniture Repair / Manufacturing, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Mines / Gravel Pits, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Landfills / Dumps, Public Buildings and Civic Organizations, Schools, Wastewater
Thallium	0.002	0.0005	**Commercial / Industrial**	Electrical / Electronic Manufacturing, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Research Laboratories
			ORGANIC CONTAMINANTS	
Alachlor	0.002	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Historic Waste Dumps / Landfills, Injection Wells
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Landfills / Dumps, Septic Systems Wells
			Agricultural / Rural	Injection Wells, Lagoons and Liquid Waste, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Atrazine	0.003	0.003	**Commercial / Industrial**	Chemical / Petroleum Processing, Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Injection Wells, Office Building / Complex, Railroad Yards
			Residential / Municipal	Apartments and Condominiums, Drinking Water Treatment, Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Schools, Septic Systems, Utility Stations, Wells
			Agricultural / Rural	Injection Wells, Lagoons and Liquid Waste, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads

Contaminant Name	MCL / HAL [1]	MCLG [2]	Source	
Benzene	0.005	zero	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Boat Repair / Refinishing, Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Office Building / Complex, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetic / Plastics Production, Synthetics / Plastics Producers, Underground Storage Tanks, Wholesale Distribution Activities, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Drinking Water Treatment, Golf Courses and Parks, Landfills / Dumps, Public Buildings and Civic Organizations, Utility Stations, Schools
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
Benzo(a)pyrene	0.0002	zero	**Commercial / Industrial**	Fleet / Trucking / Bus Terminals
Carbofuran	0.04	0.04	**Commercial / Industrial**	Chemical / Petroleum Processing, Historic Waste Dumps / Landfills, Injection Wells
			Residential / Municipal	Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Lagoons and Liquid Waste, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads,
Carbon Tetrachloride	0.005	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Public Buildings and Civic Organizations, Schools
Chlordane	0.002	zero	**Agricultural / Rural**	Pesticide / Fertilizer / Petroleum Storage Sites
Chlorobenzene	0.1	0.1	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Military Installations, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers
			Residential / Municipal	Golf Courses and Parks, Public Buildings and Civic Organizations, Schools, Utility Stations
2,4-D	0.07	0.07	**Commercial / Industrial**	Chemical / Petroleum Processing, Fleet / Trucking / Bus Terminals, Machine Shops, Retail Operations, Office Building / Complex
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Pesticide / Fertilizer / Petroleum Storage Sites
			Residential / Municipal	Golf Courses and Parks, Public Buildings and Civic Organizations, RV / Mini Storage, Schools, Utility Stations
Dalapon	0.2	0.2	**Commercial / Industrial**	Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Railroad Yards
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Housing, Injection Wells, Septic Systems, Transportation Corridors, Utility Stations, Wells, Golf Courses and Parks
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Injection Wells, Lagoons and Liquid Waste, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Di(2-ethylhexyl) adipate	0.4	0.4	**Commercial / Industrial**	Chemical / Petroleum Processing, Hardware / Lumber / Parts Stores, Metal Plating / Finishing / Fabricating, Synthetics / Plastics Producers
Di(2-ethylhexyl) phthalate	.006	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Photo Processing / Printing, Synthetics / Plastics Producers
			Residential / Municipal	Public Buildings and Civic Organizations
Dibromochloropropane	0.0002	zero	**Agricultural / Rural**	Pesticide / Fertilizer / Petroleum Storage Sites
1,2-Dibromoethane or Ethylene Dibromide (EDB)	0.00005	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Photo Processing / Printing
			Residential / Municipal	Public Buildings and Civic Organizations
1,4-Dichlorobenzene or P-Dichlorobenzene	0.075	0.075	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Fleet / Trucking / Bus Terminals, Hardware / Lumber / Parts Stores, Machine Shops, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Synthetics / Plastics Producers, Underground Storage Tanks

Contaminant Name	MCL / HAL [1]	MCLG [2]	Source	
			Residential / Municipal	Public Buildings and Civic Organizations, Schools Utility Stations
1,2-Dichlorobenzene or O-Dichlorobenzene	0.6	0.6	**Commercial / Industrial**	Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Home Manufacturing, Military Installations, Photo Processing / Printing, Synthetic / Plastics Production, Office Building / Complex
1,2-Dichloroethane or Ethylene Dichloride	0.005	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Furniture Repair / Manufacturing, Machine Shops, Medical / Vet Offices, Military Installations, Office Building / Complex, Photo Processing / Printing, Synthetic / Plastics Production, Research Laboratories, Retail Operations
			Residential / Municipal	Public Buildings and Civic Organizations, Schools, Wood / Pulp / Paper Processing, Utility Stations
1,1-Dichloroethylene or Vinylidene Chloride	0.007	0.007	**Commercial / Industrial**	Chemical / Petroleum Processing, Machine Shops, Photo Processing / Printing, Research Laboratories
cis 1,2 - Dichloroethylene	0.07	0.07	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Gas Stations, Historic Waste Dumps / Landfills, Home Manufacturing, Injection Wells, Junk / Scrap / Salvage Yards, Machine Shops, Metal Plating / Finishing / Fabricating, Military Installations, Motor Pools, Photo Processing / Printing, Synthetic / Plastics Production, Railroad Yards, Research Laboratories, Wood Preserving / Treating
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Injection Wells, Landfills / Dumps, Utility Stations, Wastewater
			Agricultural / Rural	Injection Wells, Rural Homesteads
trans 1,2 - Dichloroethylene			**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Gas Stations, Historic Waste Dumps / Landfills, Home Manufacturing, Injection Wells, Junk / Scrap / Salvage Yards, Machine Shops, Metal Plating / Finishing / Fabricating, Military Installations, Motor Pools, Photo Processing / Printing, Synthetic / Plastics Production, Railroad Yards, Research Laboratories, Wood Preserving / Treating
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Injection Wells, Landfills / Dumps, Utility Stations, Wastewater
			Agricultural / Rural	Injection Wells
Dichloromethane or Methylene Chloride	0.005	zero	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Funeral Services / Graveyards, Fleet / Trucking / Bus Terminals, Food Processing, Gas Stations, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Motor Pools, Office Building / Complex, Photo Processing / Printing, Railroad Yard / Maintenance / Fueling Areas, Research Laboratories, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Public Buildings and Civic Organizations, Schools
Dinoseb	0.007	0.007	**Agricultural / Rural**	Crops - Irrigated + Non-irrigated
Dioxin	0.00000003	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Wood / Pulp / Paper Processing
Diquat	0.1	0.1	**Commercial / Industrial**	Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Junk / Scrap / Salvage Yards, Injection Wells, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Landfills / Dumps, Schools, Septic Systems, Wells, Camp Grounds / RV Parks, Golf Courses and Parks
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Injection Wells, Lagoons and Liquid Waste, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Endothall	0.1	0.1	**Residential / Municipal**	Injection Wells, Public Buildings and Civic Organizations, Schools
Endrin	0.002	0.002	**Commercial / Industrial**	Chemical / Petroleum Processing, Research Laboratories
			Residential / Municipal	Public Buildings and Civic Organizations, RV / Mini Storage, Schools
Ethylbenzene	0.7	0.7	**Commercial / Industrial**	Cement / Concrete Plants, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Office Building / Complex, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas)

Contaminant Name	MCL / HAL [1]	MCLG [2]	Source	
Glyphosate	0.7	0.7	**Commercial / Industrial**	Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Schools, Septic Systems, Wells
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Injection Wells, Lagoons and Liquid Waste, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Heptachlor (and Epoxide)	0.0004 (0.0002)	zero	**Commercial / Industrial**	Fleet / Trucking / Bus Terminals, Photo Processing / Printing
			Residential / Municipal	Wells
Hexachlorobenzene	0.001	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Machine Shops, Military Installations, Photo Processing / Printing, Synthetics / Plastics Producers
Hexachlorocyclopentadiene	0.05	0.05	**Commercial / Industrial**	Chemical / Petroleum Processing
Lindane	0.0002	0.0002	**Commercial / Industrial**	Construction / Demolition, Fleet / Trucking / Bus Terminals, Photo Processing / Printing
			Residential / Municipal	Landfills / Dumps, Public Buildings and Civic Organizations
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
Methoxychlor	0.04	0.04	**Commercial / Industrial**	Chemical / Petroleum Processing, Fleet / Trucking / Bus Terminals, Medical / Vet Offices, Military Installations, Photo Processing / Printing
			Residential / Municipal	Golf Courses and Parks, Public Buildings and Civic Organizations, RV / Mini Storage
Oxamyl (Vydate)	0.2	0.2	**Commercial / Industrial**	Chemical / Petroleum Processing, Historic Waste Dumps / Landfills, Injection Wells
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Landfills / Dumps, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Lagoons and Liquid Waste, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Pentachlorophenol	0.001	zero	**Commercial / Industrial**	Fleet / Trucking / Bus Terminals, Food Processing, Machine Shops, Metal Plating / Finishing / Fabricating, Synthetics / Plastics Producers
Picloram	0.5	0.5	**Commercial / Industrial**	Historic Waste Dumps / Landfills, Injection Wells
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Septic Systems, Transportation Corridors, Utility Stations, Wells,
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Injection Wells, Lagoons and Liquid Waste, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Polychlorinated Biphenyls	.0005	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Metal Plating / Finishing / Fabricating, Research Laboratories, Wood / Pulp / Paper Processing
			Residential / Municipal	Drinking Water Treatment
Propylene Dichloride or 1,2-Dichloropropane	0.005	zero	**Commercial / Industrial**	Fleet / Trucking / Bus Terminals, Photo Processing / Printing
Simazine	0.004	0.004	**Commercial / Industrial**	Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Septic Systems, Transportation Corridors, Utility Stations Wells
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Lagoons and Liquid Waste, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Styrene	0.1	0.1	**Commercial / Industrial**	Cement / Concrete Plants, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Home Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Retail Operations, Synthetics / Plastics Producers, Wholesale Distribution Activities, Wood / Pulp / Paper Processing

Contaminant Name	MCL / HAL [1]	MCLG [2]	Source	
Tetrachloroethylene or Perchlorethylene (Perk)	0.005	zero	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Drinking Water Treatment, Dry Cleaners / Dry Cleaning, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals Food Processing, Gas Stations, Hardware / Lumber / Parts Stores, Historic Waste Dumps / Landfills, Home Manufacturing, Injection Wells, Junk / Scrap / Salvage Yards, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Mines / Gravel Pits, Motor Pools, Office Building / Complex, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Injection Wells, Public Buildings and Civic Organizations, Schools, Utility Stations, Wastewater
Toluene	1	1	**Commercial / Industrial**	Cement / Concrete Plants, Chemical / Petroleum Processing, Drinking Water Treatment, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Research Laboratories, Synthetics / Plastics Producers, Retail Operations, Office Building / Complex, Photo Processing / Printing, Wood / Pulp / Paper Processing
			Residential / Municipal	Public Buildings and Civic Organizations, Schools, Utility Stations
Total Trihalomethanes	0.1	None	**Residential / Municipal**	Drinking Water Treatment
Toxaphene	0.003	zero	**Commercial / Industrial**	Fleet / Trucking / Bus Terminals
2,4,5-TP (Silvex)	0.05	0.05	**Commercial / Industrial**	Medical / Vet Offices
			Agricultural / Rural	Pesticide / Fertilizer / Petroleum Storage Sites
1,2,4-Trichlorobenzene	0.07	0.07	**Commercial / Industrial**	Chemical / Petroleum Processing
1,1,2-Trichloroethane	0.005	0.003	**Commercial / Industrial**	Dry Cleaners / Dry Cleaning, Electrical / Electronic Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Photo Processing / Printing
1,1,1-Trichloroethane or Methyl Chloroform	0.2	0.2	**Commercial / Industrial**	Body Shops/Repair Shops, Chemical / Petroleum Processing, Dry Cleaners / Dry Cleaning, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Mines / Gravel Pits, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Retail Operations, Wholesale Distribution Activities, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Construction / Demolition Areas, Drinking Water Treatment, Landfills / Dumps, Naturally Occuring, Public Buildings and Civic Organizations, Schools
Trichloroethylene or TCE	0.005	zero	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Historic Waste Dumps / Landfills, Home Manufacturing, Injection Wells, Junk / Scrap / Salvage Yards, Machine Shops, Metal Plating / Finishing / Fabricating, Military Installations, Motor Pools, Office Building / Complex, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Synthetics / Plastics Producers, Underground Storage Tanks, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Injection Wells, Public Buildings and Civic Organizations, Schools, Utility Stations
Vinyl Chloride	0.002	zero	**Commercial / Industrial**	Boat Repair / Refinishing, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Fleet / Trucking / Bus Terminals, Research Laboratories, Retail Operations, Synthetic / Plastics Production
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks Housing, Public Buildings and Civic Organizations, Septic Systems, Waste Transfer / Recycling Wastewater
			Agricultural / Rural	Confined Animal Feeding Operations Lagoons and Liquid Waste, Rural Homesteads
Xylene (Mixed Isomers)	10	10	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Production, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Public Buildings and Civic Organizations, Schools, Utility Stations,
			Microbiological	

Contaminant Name	MCL / HAL [1]	MCLG [2]	Source	
Coliform	5.0%[4]	Zero	**Commercial / Industrial**	Boat Repair / Refinishing
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Housing, Septic Systems, Waste Transfer / Recycling, Wastewater
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Lagoons and Liquid Waste, Rural Homesteads
Giardia Lambia	zero	TT	**Commercial / Industrial**	Boat Repair / Refinishing
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Housing, Septic Systems, Waste Transfer / Recycling, Wastewater
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Lagoons and Liquid Waste, Rural Homesteads,
Legionella	zero	TT	**All**	Surface Water
Viruses	TT	N/A	**Commercial / Industrial**	Boat Repair / Refinishing
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Housing, Septic Systems, Waste Transfer / Recycling, Wastewater
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Lagoons and Liquid Waste Rural Homesteads
			Other	
Beta particles and photon emitters*	Beta: 4 millirems per year;	none	**Commercial / Industrial**	Medical / Vet Offices, Military Installations, Naturally Occurring
Gross Alpha particle activity	15 pCi/L per year;	none	same as above	same as above
Radium 226 & Radium 228 (combined)	5 pCi/L per year	none	same as above	same as above
Turbidity	TT	N/A	**Commercial / Industrial**	Construction / Demolition, Home Manufacturing, Mines / Gravel Pits
			Residential / Municipal	Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Transportation Corridors
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Managed Forests
			SECONDARY DRINKING WATER CONTAMINANTS	
Aluminum (Fume or Dust)	0.05 to 0.2		**Commercial / Industrial**	Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Hardware / Lumber / Parts Stores, Machine Shops, Metal Plating / Finishing / Fabricating, Photo Processing / Printing
Chloride	250		**Commercial / Industrial**	Construction / Demolition
Flouride	2.0		**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Injection Wells, Machine Shops, Metal Plating / Finishing / Fabricating
			Residential / Municipal	Drinking Water Treatment, Injection Wells, Wastewater, Wells
Iron	0.3		**Commercial / Industrial**	Historic Waste Dumps / Landfills, Junk / Scrap / Salvage Yards, Naturally Occurring
			Residential / Municipal	Naturally Occurring
			Agricultural / Rural	Naturally Occurring
Manganese	0.05		**Commercial / Industrial**	Historic Waste Dumps / Landfills, Junk / Scrap / Salvage Yards, Naturally Occurring
			Residential / Municipal	Naturally Occurring
Silver	0.1		**Commercial / Industrial**	Medical / Vet Offices, Naturally Occurring
			Residential / Municipal	Naturally Occurring
			Agricultural / Rural	Naturally Occurring
Sulfate	500	250	**Commercial / Industrial**	Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Historic Waste Dumps / Landfills, Metal Plating / Finishing / Fabricating, Mines / Gravel Pits, Wood Preserving / Treating, Injection Wells, Junk / Scrap / Salvage Yards
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Injection Wells, Septic Systems, Wastewater, Wells
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Injection Wells, Lagoons and Liquid Waste, Rural Homesteads

Contaminant Name	MCL / HAL [1]	MCLG [2]	Source
OTHER CONTAMINANTS OF CONCERN*			
Inorganic Contaminants			
Ammonia		Residential / Municipal	Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Mines / Gravel Pits, Office Building / Complex, Photo Processing / Printing, Retail Operations, Wood / Pulp / Paper Processing, Synthetic / Plastics Production
		Residential / Municipal	Landfills / Dumps
		Agricultural / Rural	Crops - Irrigated + Non-irrigated
Ammoniacal Copper Arsenate		Commercial / Industrial	Boat Repair / Refinishing, Construction / Demolition, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Railroad Yards, Wood Preserving / Treating, Wood / Pulp / Paper Processing
Ammonium Persulfate		Commercial / Industrial	Automobile Body Shops / Repair Shops, Electrical / Electronic Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating
Boric Acid		Commercial / Industrial	Electrical / Electronic Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Metal Plating / Finishing / Fabricating, Synthetic / Plastics Production
		Residential / Municipal	Utility Stations
Bromine		Commercial / Industrial	Injection Wells
		Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Septic Systems, Wells
		Agricultural / Rural	Injection Wells, Rural Homesteads
Calcium Flouride		Commercial / Industrial	Electrical / Electronic Manufacturing
Calcium Hypochlorate		Commercial / Industrial	Injection Wells
		Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Septic Systems, Wells
		Agricultural / Rural	Injection Wells, Rural Homesteads
Chlorine		Commercial / Industrial	Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Injection Wells, Machine Shops, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
		Residential / Municipal	Airports (Maintenance / Fueling Areas), Apartments and Condominiums, Housing, Injection Wells, Landfills / Dumps, Public Buildings and Civic Organizations, Schools, Utility Stations
		Agricultural / Rural	Injection Wells, Rural Homesteads
Chlorine Dioxide		Commercial / Industrial	Chemical / Petroleum Processing, Wood / Pulp / Paper Processing
Chromated Copper Arsenic		Commercial / Industrial	Boat Repair / Refinishing, Construction / Demolition, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Railroad Yards, Wood Preserving / Treating, Wood / Pulp / Paper Processing
Chromic Acid		Commercial / Industrial	Wood / Pulp / Paper Processing
Hydrochloric Acid or Muriatic Acid		Commercial / Industrial	Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Injection Wells, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Mines / Gravel Pits, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
		Residential / Municipal	Airports (Maintenance / Fueling Areas), Apartments and Condominiums, Housing, Injection Wells, Landfills / Dumps, Septic Systems, Wells
		Agricultural / Rural	Injection Wells, Rural Homesteads
Hydrogen Peroxide		Commercial / Industrial	Chemical / Petroleum Processing
Iodine		Commercial / Industrial	Injection Wells, Office Building / Complex

Contaminant Name	MCL / HAL [1]	MCLG [2]	Source	
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Rural Homesteads
Nickel	0.01	0.01	Commercial / Industrial	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Synthetics / Plastics Producers
Nitric Acid			Commercial / Industrial	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Agricultural / Rural	Confined Animal Feeding Operations
Peroxide			Commercial / Industrial	Dry Cleaners / Dry Cleaning, Historic Waste Dumps / Landfills, Injection Wells, Synthetic / Plastics Production
			Residential / Municipal	Injection Wells, Landfills / Dumps, Septic Systems, Wells
Phosphates			Commercial / Industrial	Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Schools, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Phosphoric Acid Ortho-			Commercial / Industrial	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing Machine Shops, Metal Plating / Finishing / Fabricating, Mines / Gravel Pits, Office Building / Complex, Photo Processing / Printing, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Drinking Water Treatment
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
Phosphorus			Commercial / Industrial	Pesticide / Fertilizer / Petroleum Storage Sites
Potassium Alum (dodecahydrate)			Commercial / Industrial	Medical / Vet Offices, Research Laboratories
Potassium Bromide			Commercial / Industrial	Medical / Vet Offices, Research Laboratories
Sodium			Residential / Municipal	Transportation Corridors, Utility Stations
Sodium Carbonate			Commercial / Industrial	Injection Wells, Medical / Vet Offices Research Laboratories
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Rural Homesteads
Sodium Chloride			Commercial / Industrial	Transportation Corridors, Utility Stations
Sodium Cyanide			Commercial / Industrial	Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Furniture Repair / Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Synthetic / Plastics Production, Research Laboratories, Retail Operations
			Residential / Municipal	Public Buildings and Civic Organizations, Schools, Utility Stations
Sodium Hypochlorate			Commercial / Industrial	Injection Wells
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Rural Homesteads
Sodium Sulfite			Commercial / Industrial	Medical / Vet Offices, Research Laboratories

Contaminant Name	MCL / HAL [1]	MCLG [2]	Source	
Sulfuric Acid			Commercial / Industrial	Automobile Body Shops / Repair Shops, Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Drinking Water Treatment, Landfills / Dumps, Public Buildings and Civic Organizations, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
Thiosulfates			Commercial / Industrial	Medical / Vet Offices, Research Laboratories
Tin			Commercial / Industrial	Automobile Body Shops / Repair Shops, Furniture Repair / Manufacturing, Historic Waste Dumps / Landfills, Injection Wells, Machine Shops, Metal Plating / Finishing / Fabricating, Mines / Gravel Pits, Junk / Scrap / Salvage Yards
			Residential / Municipal	Landfills / Dumps, Injection Wells, Utility Stations, Wastewater, Wells
Zinc (Fume or Dust)			Commercial / Industrial	Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Synthetic / Plastics Production
Organic Contaminants				
Acetone			Commercial / Industrial	Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Retail Operations, Synthetic / Plastics Production, Wood / Pulp / Paper Processing
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
			Residential / Municipal	Public Buildings and Civic Organizations, Schools, Utility Stations
Acetylene			Commercial / Industrial	Metal Plating / Finishing / Fabricating
Acrylamide			Commercial / Industrial	Chemical / Petroleum Processing, Fleet / Trucking / Bus Terminals, Medical / Vet Offices, Photo Processing / Printing
			Residential / Municipal	Public Buildings and Civic Organizations, Schools
Amyl Acetate			Commercial / Industrial	Dry Cleaners / Dry Cleaning, Electrical / Electronic Manufacturing
Benomyl			Commercial / Industrial	Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Office Building / Complex, Research Laboratories
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Schools, Septic Systems, Wells
			Agricultural / Rural	Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Chloroform			Commercial / Industrial	Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, RV / Mini Storage, Synthetics / Plastics Producers, Research Laboratories, Wood / Pulp / Paper Processing
			Residential / Municipal	Public Buildings and Civic Organizations Schools, Utility Stations, Wastewater
Chlorpyrifos			Commercial / Industrial	Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Landfills / Dumps, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Injection Wells, Schools, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Copper Quinolate			Commercial / Industrial	Boat Repair / Refinishing, Construction / Demolition, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Railroad Yards, Wood Preserving / Treating, Wood / Pulp / Paper Processing
Creosote			Commercial / Industrial	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Fleet / Trucking / Bus Terminals, Machine Shops, Wood Preserving / Treating
			Residential / Municipal	Schools, Utility Stations

Contaminant Name	MCL / HAL [1]	MCLG [2]	Source	
Cyanuric Acid			Commercial / Industrial	Injection Wells
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Rural Homesteads
Epichlorohydrin			Commercial / Industrial	Chemical / Petroleum Processing, Fleet / Trucking / Bus Terminals
Epoxy			Commercial / Industrial	Boat Repair / Refinishing, Construction / Demolition, Furniture Repair / Manufacturing, Wood Preserving / Treating, Wood / Pulp / Paper Processing, Historic Waste Dumps / Landfills, Home Manufacturing, Junk / Scrap / Salvage Yards
			Residential / Municipal	Apartments and Condominiums, Housing, Landfills / Dumps
Ethane			Commercial / Industrial	Chemical / Petroleum Processing
Ethylene			Commercial / Industrial	Chemical / Petroleum Processing
Ethylene Glycol			Commercial / Industrial	Automobile Body Shops / Repair Shops, Cement / Concrete Plants, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Hardware / Lumber / Parts Stores, Junk / Scrap / Salvage Yards, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Landfills / Dumps
Flourocarbon 113 (Freon) or 112-trichloro-122-trifluoroethane			Commercial / Industrial	Dry Cleaners / Dry Cleaning, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers
			Residential / Municipal	Airports (Maintenance / Fueling Areas)
			Agricultural / Rural	Confined Animal Feeding Operations
Formaldehyde (K157)			Commercial / Industrial	Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Home Manufacturing, Machine Shops, Medical / Vet Offices, Wood Preserving / Treating, Wood / Pulp / Paper Processing, Metal Plating / Finishing / Fabricating, Office Building / Complex, Synthetics / Plastics Producers, Photo Processing / Printing, Research Laboratories
			Residential / Municipal	Public Buildings and Civic Organizations, RV / Mini Storage, Schools, Utility Stations
Hexachlorophene			Commercial / Industrial	Electrical / Electronic Manufacturing
Hydrogen Cyanide			Commercial / Industrial	Machine Shops, Metal Plating / Finishing / Fabricating
Hydroquinone			Commercial / Industrial	Chemical / Petroleum Processing, Photo Processing / Printing, Synthetics / Plastics Producers
Isopropanol			Commercial / Industrial	Boat Repair / Refinishing, Injection Wells, Office Building / Complex, Junk / Scrap / Salvage Yards
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Schools, Housing, Injection Wells, Landfills / Dumps, Septic Systems, Wastewater, Wells
				Injection Wells, Rural Homesteads
Isopropyl Alcohol (Manufacturing Strong-acid Process)			Commercial / Industrial	Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Drinking Water Treatment
Kerosene			Commercial / Industrial	Chemical / Petroleum Processing, Synthetics / Plastics Producers
Methane			Residential / Municipal	Landfills / Dumps, Septic Systems
			Agricultural / Rural	Lagoons and Liquid Waste
Methanol			Commercial / Industrial	Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Injection Wells, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers, Retail Operations, Wood / Pulp / Paper Processing
			Residential / Municipal	Injection Wells, Public Buildings and Civic Organizations, Schools, Utility Stations

Contaminant Name	MCL / HAL [1]	MCLG [2]	Source	
Nitrosamine			Commercial / Industrial	Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks,Golf Courses and Parks, Housing Injection Wells, Landfills / Dumps, Schools, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Polyurethane			Commercial / Industrial	Boat Repair / Refinishing, Construction / Demolition, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Railroad Yards, Wood Preserving / Treating, Wood / Pulp / Paper Processing
Strychnine			Commercial / Industrial	Machine Shops
			Residential / Municipal	Public Buildings and Civic Organizations, Schools
			Commercial / Industrial	Pesticide / Fertilizer / Petroleum Storage Sites
1,1,2,2-Tetrachloroethane			Commercial / Industrial	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Fleet / Trucking / Bus Terminals, Furniture Repair / Manufacturing, Gas Stations, Junk / Scrap / Salvage Yards, Metal Plating / Finishing / Fabricating, Motor Pools, Photo Processing / Printing, Synthetics / Plastics Producers
Toluenediisocyanate (Mixed Isomers)			Commercial / Industrial	Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Machine Shops, Photo Processing / Printing Research, Laboratories, Synthetics / Plastics Producers
			Residential / Municipal	Public Buildings and Civic Organizations, Schools
			MICROBIOLOGICAL	
Cryptosporidium			Commercial / Industrial	Boat Repair / Refinishing
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Housing, Septic Systems, Waste Transfer / Recycling, Wastewater
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Lagoons and Liquid Waste, Rural Homesteads

Notes :

[1]MCL = Maximum Contaminant Level; HAL = Health Advisory Limit

[2]MCLG - Maximum Contaminant Level Goal

[3]TT- Treatment Technique

[4] No more than 5.0% of samples should detect total coliforms in one month. Every system that detects total coliform must be analyzed for fecal coliforms.

* **BOLD** Denotes contaminant is on the Drinking Water Contaminant Candidate List

Primary drinking water contaminants are federally regulated

Secondary drinking water contaminanats are un-enforcable federal guidelines regarding taste, odor, color and certain other non-aesthetic effects of drinking water.

Contaminant Candidate List are contamianants under consideration for federal regulation or guideline development

APPENDIX C
SIGNIFICANT POTENTIAL CONTAMINATION SOURCES

Source	Contaminant*
Commercial / Industrial	
Automobile, Body Shops/Repair Shops	**Arsenic**, Ammonium Persulfate, **Barium**, **Benzene**, **Cadmium**, **Chlorobenzene**, **Copper**, Creosote, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, 1,4-Dichlorobenzene or P-Dichlorobenzene**, Ethylene Glycol, **Lead**, Flouride, **1,1,1-Trichloroethane or Methyl Chloroform**, **Dichloromethane or Methylene Chloride**, **Nickel**, Nitric Acid, Phosphoric Acid (Ortho-), Sulfuric Acid, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Trichloroethylene or TCE**, Tin, **Xylene (Mixed Isomers)**
Boat Repair/Refinishing	Ammoniacal Copper Arsenate, **Benzene**, **Cadmium**, Chromated Copper Arsenic, **Coliform**, Copper Quinolate, Cryptosporidium, Epoxy, ***Giardia Lambia***, Isopropanol, **Lead**, **Mercury**, **Nitrate**, **Nitrite**, Polyurethane, **Vinyl Chloride**, Viruses
Cement/Concrete Plants	Acetone, **Barium**, **Benzene**, **Dichloromethane or Methylene Chloride**, **Ethylbenzene**, Ethylene Glycol, **Lead**, Methanol, **Styrene**, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, **Xylene (Mixed Isomers)**
Chemical/Petroleum Processing	Acetone, **Acrylamide**, **Arsenic**, **Atrazine**, **Alachlor**, Aluminum (Fume or Dust), Ammonia, **Barium**, **Benzene**, **Cadmium**, **Carbofuran**, **Carbon Tetrachloride**, Chlorine, Chlorine Dioxide, **Chlorobenzene**, Chloroform, **Copper**, Creosote, **Cyanide**, Captan, **2,4-D**, **1,2-Dibromoethane or Ethylene Dibromide (EDB)**, 1,2-Dichlorobenzene or O-Dichlorobenzene, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **1,1-Dichloroethylene or Vinylidene Chloride**, cis 1,2 Dichloroethylene, **Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) adipate**, **Di(2-ethylhexyl) phthlate**, **1,2-Dichloroethane or Ethylene Dichloride**, **Dioxin**, **Endrin**, **Epichlorohydrin**, Ethane, Ethylenzene, Ethylene, Ethylene Glycol, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, **Hexachlorobenzene**, **Hexachlorocyclopentadiene**, Hydrochloric Acid or Muriatic Acid, Hydroquinone, Hydrogen Peroxide, Isopropyl Alcohol (Manufacturing, Strong-Acid Process), Kerosene, **Lead**, **Mercury**, Methanol, **Methoxychlor**, Naphthalene or K156, **Nickel**, Nitric Acid, Oxamyl (Vydate), **Polychlorinated Biphenyls**, Phosphoric Acid Ortho-, **Selenium**, Sodium Cyanide, **Styrene**, Sulfate, Sulfuric Acid, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluenediisocyanate (Mixed Isomers), **1,2,4-Trichlorobenzene**, **1,1,1-Trichloroethane or Methyl Chloroform**, **Trichloroethylene or TCE**, **Vinyl Chloride**, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)

Construction/Demolition	Acetone, **Arsenic**, **Asbestos**, Ammonia, Ammoniacal Copper Arsenate, **Benzene**, **Cadmium**, Chloride, Chromated Copper Arsenic, **Copper**, Copper Quinolate, **Cyanide**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, Epoxy, Fluorides, Formaldehyde or K157, **Lead**, Lindane, Methanol, **Nickel**, Polyurethane, Phosphoric Acid Ortho-, **Selenium**, Sodium **Cyanide**, Sulfuric Acid, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, Turbidity, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)
Dry Cleaners/Dry Cleaning	Amyl Acetate, Flourocarbon 113 (Freon), Peroxide, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, 1,1,2-Trichloroethane
Dry Goods Manufacturing	Acetone, Ammonia, **Barium**, **Benzene**, **Cadmium**, Chlorine, **Copper**, **Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthlate**, Formaldehyde or K157, Hydrochloric Acid or Muriatic Acid, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, Methanol, **1,1,1-Trichloroethane or Methyl Chloroform**, Nitric Acid, **Polychlorinated Biphenyls**, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluene Diisocyanate (Mixed Isomers), Trichloroethylene or TCE, **Xylene (Mixed Isomers)**
Electrical/Electronic Manufacturing	Acetone, Aluminum (Fume or Dust), Ammonia, Ammonium Persulfate, Amyl Acetate, **Antimony**, **Arsenic**, **Barium**, **Benzene**, Boric Acid, **Cadmium**, Chlorine, **Chlorobenzene**, Chloroform, **Copper**, **Cyanide**, Calcium Flouride, **Carbon Tetrachloride**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,2-Dichloroethane or Ethylene Dichloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthlate**, **Ethylbenzene**, Ethylene Glycol, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, Hexachlorophene, Hydrochloric Acid or Muriatic Acid, Isopropyl Alcohol (Manufacturing, Strong-Acid Process), **Lead**, **Mercury**, Methanol, Naphthalene or K156, **Nickel**, Nitric Acid, **Polychlorinated Biphenyls**, Phosphoric Ac id Ortho-, **Selenium**, **Styrene**, Sulfate, Sulfuric Acid, Sodium Cyanide, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, 1,1,2-Trichloroethane, Trichloroethylene or TCE, **Thallium**, **Toluene**, Toluene Diisocyanate, (Mixed Isomers), **Vinyl Chloride**, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)

Fleet/Trucking/ Bus Terminals	Acetone, **Arsenic**, **Acrylamide**, **Barium**, **Benzene**, **Benzo(a)pyrene**, **Cadmium**, **Chlorobenzene**, Chloroform, Creosote, **Cyanide**, **Carbon Tetrachloride**, **2,4-D**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **1,2-Dichloroethane or Ethylene Dichloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthlate**, **Epichlorohydrin**, Formaldehyde or K157, **Heptachlor (and Epoxide)**, Hydrochloric Acid or Muriatic Acid, **Lead**, Lindane, **Mercury**, Methanol, **Methoxychlor**, Naphthalene or K156, **Pentachlorophenol**, Phosphoric Acid Ortho-, Propylene Dichloride or **1,2-Dichloropropane**, **Selenium**, **Styrene**, Sulfuric Acid, Sodium Cyanide, **Toxaphene**, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluene Diisocyanate (Mixed Isomers), **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**
Food Processing	**Arsenic**, Ammonia, **Benzene**, **Cadmium**, Chlorine, Chloroform, **Copper**, **Carbon Tetrachloride**, **Dichloromethane or Methylene Chloride**, Formaldehyde or K157, Hydrochloric Acid or Muriatic Acid, **Lead**, **Mercury**, Methanol, Nitric Acid, **Picloram**, Phosphoric Acid Ortho-, Sulfuric Acid, Sodium Cyanide, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluene Diisocyanate (Mixed Isomers), **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Xylene (Mixed Isomers)**
Funeral Services/Graveyards	**Atrazine**, Benomyl, Chlorpyrifos, Diazinon, **Diquat**, **Glyphosate**, **Dichloromethane or Methylene Chloride**, Nitrosamine, Phosphates
Furniture Repair/Manufacturing	Ammoniacal Copper Arsenate, **Barium**, Chromated Copper Arsenic, Copper Quinolate, **1,2-Dichloroethane or Ethylene Dichloride**, **Dichloromethane or Methylene Chloride**, Epoxy, **Ethylbenzene**, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, **Lead**, **Mercury**, **Nickel**, Polyurethane, Phosphoric Acid Ortho-, **Selenium**, Sodium Cyanide, 1,1,2,2-Tetrachloroethane, Trichloroethylene or TCE, Tin
Gas Stations	**cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE
Hardware/Lumber/Parts Stores	Acetone, Aluminum (Fume or Dust), Ammonia, Ammoniacal Copper Arsenate, **Barium**, **Benzene**, **Cadmium**, Captan, Chlorine, **Chlorobenzene**, Chloroform, Chromated Copper Arsenic, **Copper**, Copper Quinolate, **Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl)adipate**, **Di(2-ethylhexyl) phthlate**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **Ethylbenzene**, Ethylene Glycol, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Hydrochloric Acid or Muriatic Acid, **Lead**, **Mercury**, Methanol, **Nickel**, Nitric Acid, Polyurethane, Phosphoric Acid Ortho-, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Toluene**, **Xylene (Mixed Isomers)**

Historic Waste Dumps/Landfills	**Atrazine**, **Alachlor**, Benomyl, Chlorpyrifos, **Carbofuran**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Diquat**, **Dalapon**, Diazinon, Epoxy, **Glyphosate**, **Dichloromethane or Methylene Chloride**, Manganese, **Nitrate**, **Nitrite**, Nitrosamine, Oxamyl (Vydate), Peroxide, Phosphates, **Picloram**, Sulfate, **Simazine**, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE, Tin
Home Manufacturing	Acetone, **Arsenic**, Ammonia, Ammoniacal Copper Arsenate, **Barium**, **Benzene**, **Cadmium**, Chlorine, **Chlorobenzene**, Chloroform, Chromated Copper Arsenic, **Copper**, Copper Quinolate, **Carbon Tetrachloride**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthlate**, Epoxy, **Ethylbenzene**, Formaldehydeor K157, Hydrochloric Acid or Muriatic Acid, **Lead**, **Mercury**, Methanol, Naphthalene or K156, **Nickel**, Nitric Acid, Polyurethane, Phosphoric Acid Ortho-, **Selenium**, **Styrene**, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, 1,1,2,2-Tetrachloroethane, **Toluene**, Turbidity, **Xylene (Mixed Isomers)**
Injection Wells	**Atrazine**, **Alachlor**, Benomyl, Bromine, Chlorpyrifos, Cyanuric Acid, Calcium Hypochlorate, Chlorine, **Carbofuran**, **Dalapon**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Diquat**, Diazinon, **Endothall**, Flouride, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, Methanol, Nitrosamine, Oxamyl (Vydate), Peroxide, Phosphates, **Picloram**, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, Sulfate, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE, Tin
Junk/Scrap/Salvage Yards	**Barium**, Benomyl, **Benzene**, Boric Acid, Chlorpyrifos, Chromated Copper Arsenic, **Copper**, cis **Dalapon**, 1,2-Dichloroethylene, **Diquat**, Diazinon, Epoxy, Ethylene Glycol, **Glyphosate**, Isopropanol, **Lead**, **N** Manganese, **ickel**, Nitric Acid, Nitrosamine, **Polychlorinated Biphenyls**, Phosphates, Sulfate, **Simazine**, Trichloroethylene or TCE, 1,1,2,2 - Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Tin
Machine Shops	Acetone, **Arsenic**, Aluminum (Fume or Dust), Ammonia, Ammonium Persulfate, **Barium**, **Benzene**, Boric Acid, **Cadmium**, Chlorine, **Chlorobenzene**, Chloroform, **Copper**, Creosote, **Cyanide**, **Carbon Tetrachloride 2,4-D**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **1,2-Dichloroethane or Ethylene Dichloride**, **1,1-Dichloroethylene or Vinylidene Chloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthlate**, **Ethylbenzene**, Ethylene Glycol, Flouride, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, **Hexachlorobenzene**, Hydrochloric Acid or Muriatic Acid, Hydrogen Cyanide, Isopropyl Alcohol (Manufacturing, Strong-Acid Process), **Lead**, **Mercury**, Methanol, Naphthalene or K156, **Nickel**, Nitric Acid, **Polychlorinated Biphenyls**, **Pentachlorophenol**, Phosphoric Acid Ortho-, **Selenium**, Strychnine, **Styrene**, Sulfuric Acid, Sodium Cyanide, **Tetrachloroethylene or Perchlorethylene (Perk)**, Tetrachloroethane-1,1,2,2 , Tin, **Toluene**, Toluenediisocyanate (Mixed Isomers) **1,1,1-Trichloroethane or Methyl Chloroform**,1,1,2-Trichloroethane, Trichloroethylene or TCE, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)

Medical/Vet Offices	Acetone, **Arsenic**, **Acrylamide**, **Barium**, **Benzene**, **Cadmium**, Chloroform, **Copper**, **Cyanide**, **Carbon Tetrachloride**, **Dichloromethane or Methylene Chloride**, **1,2-Dichloroethane or Ethylene Dichloride**, Ethylene Glycol, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, Glutaldehyde, Hydrochloric Acid or Muriatic Acid, **Lead**, **Mercury**, Methanol, **Methoxychlor**, **1,1,1-Trichloroethane or Methyl Chloroform**, **Nickel**, Potassium Alum (dodecahydrate), Potassium Bromide, Radionuclides, **Selenium**, Silver, Sulfuric Acid, Sodium Carbonate, Sodium Cyanide, Sodium Sulfite, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **2,4,5-TP (Silvex)**, **Thallium**, Thiosulfates, **Toluene**, **Xylene (Mixed Isomers)**
Metal Plating/Finishing/Fabricating	Acetone, **Antimony**, Acetylene, Aluminum (Fume or Dust), Ammonia, Ammonium Persulfate, **Arsenic**, **Barium**, **Benzene**, Boric Acid, **Cadmium**, **Carbon Tetrachloride**, Chlorine, **Chlorobenzene**, Chloroform, **Chromium**, **Copper**, **Cyanide**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) adipate**, **Ethylbenzene**, Ethylene Glycol, Flouride, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, Hydrochloric Acid or Muriatic Acid, Hydrogen Cyanide, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, **Mercury**, Manganese, Methanol, Naphthalene or K156, **Nickel**, Nitric Acid, **Polychlorinated Biphenyls**, **Pentachlorophenol**, Phosphoric Acid Ortho-, **Selenium**, **Styrene**, Sulfate, Sulfuric Acid, Sodium Cyanide, **Tetrachloroethylene or Perchlorethylene (Perk)**, 1,1,2,2 Tetrachloroethane, **Thallium**, Tin, **Toluene**, **1,1,1-Trichloroethane or Methyl Chloroform**, 1,1,2-Trichloroethane, Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)
Military Installations	**Arsenic**, **Barium**, **Benzene**, **Cadmium**, **Chlorobenzene**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,2-Dichloroethane or Ethylene Dichloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Hexachlorobenzene**, **Lead**, **Mercury**, Methanol, **Methoxychlor**, **1,1,1-Trichloroethane or Methyl Chloroform**, Radionuclides, **Selenium**, **Tetrachloroethylene or Perchlorethylene (Perk)**, 1,1,2,2 Tetrachloroethane, **Toluene**, Trichloroethylene or TCE
Mines/Gravel Pits	Ammonia, Hydrochloric Acid or Muriatic Acid, **Lead**, Naphthalene or K156, Phosphoric Acid Ortho-, **Selenium**, Sulfate, **Tetrachloroethylene or Perchlorethylene (Perk)**, Tin, **1,1,1-Trichloroethane or Methyl Chloroform**, Turbidity
Motor Pools	**cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, 1,1,2,2 Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE

Office Building/Complex	Acetone, **Atrazine**, Ammonia, **Barium**, Benomyl, **Benzene**, **Cadmium**, Chlorine, Chlorpyrifos, **Copper**, **2,4-D**, Diazinon, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **Dichloromethane or Methylene Chloride**, **Diquat**, **1,2-Dichloroethane or Ethylene Dichloride**, **Ethylbenzene**, Ethylene Glycol, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, **Mercury**, Methanol, Nitric Acid, Nitrosamine, Phosphates, Phosphoric Acid Ortho-, **Selenium**, Sulfuric Acid, **Simazine**, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Toluene**, **Vinyl Chloride**, **Xylene (Mixed Isomers)**
Photo Processing/Printing	Acetone, **Acrylamide**, Aluminum (Fume or Dust), Ammonia, **Arsenic**, **Barium**, **Benzene**, **Cadmium**, **Carbon Tetrachloride**, Chlorine, **Chlorobenzene**, Chloroform, **Copper**, **Cyanide**, **1,1-Dichloroethylene or Vinylidene Chloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthlate**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **1,2-Dichloroethane or Ethylene Dichloride**, **1,2-Dibromoethane or Ethylene Dibromide (EDB)**, Ethylene Glycol, Freon 113 or CFC 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, **Heptachlor (and Epoxide)**, **Hexachlorobenzene**, Hydrochloric Acid or Muriatic Acid, Hydroquinone, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, Lindane, **Mercury**, Methanol, **Methoxychlor**, **Nickel**, Nitric Acid, Phosphoric Acid Ortho-, Propylene Dichloride or **1,2-Dichloropropane**, **Selenium**, Sodium Cyanide, **Styrene**, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, 1,1,2,2-Tetrachloroethane, **Toluene**, Toluene Diisocyanate (Mixed Isomers), 1,1,2-Trichloroethane, Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)
Synthetic / Plastics Production	Acetone, **Antimony**, Ammonia, **Arsenic**, **Barium**, **Benzene**, Boric Acid, **Cadmium**, Captan, **Carbon Tetrachloride**, Chlorine, **Chlorobenzene**, Chloroform, **Copper**, **Cyanide**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **1,2-Dichloroethane or Ethylene Dichloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) adipate**, **Di(2-ethylhexyl) phthlate**, **Ethylbenzene**, Ethylene Glycol, Freon 113 or CFC 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, **Hexachlorobenzene**, Hydrochloric Acid or Muriatic Acid, Hydroquinone, Isopropyl Alcohol (Manufacturing, Strong-Acid Process), Kerosene, **Lead**, **Mercury**, Methanol, Methyl Chloroform or 1,1,1-Trichloroethane, **Nickel**, Nitric Acid, **Pentachlorophenol**, Peroxide, Phosphoric Acid Ortho-, **Selenium**, Sodium Cyanide, **Styrene**, Sulfuric Acid, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluene Diisocyanate (Mixed Isomers), Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)
RV/Mini Storage	**Arsenic**, **Barium**, Chloroform, **Cyanide**, **2,4-D**, **Endrin**, Formaldehyde or K157, **Lead**, **Methoxychlor**

Railroad Yards/Maintenance/Fueling Areas	**Atrazine**, Ammoniacal Copper Arsenate, **Barium**, **Benzene**, **Cadmium**, Chlorine, Chromated Copper Arsenic, Copper Quinolate, **Dalapon**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, Polyurethane, **Lead**, **Mercury**, Tetrachloroethane-1,1,2,2 , Trichloroethylene or TCE, **Tetrachloroethylene or Perchlorethylene (Perk)**
Research Laboratories	Acetone, **Arsenic**, **Barium**, Benomyl, **Benzene**, **Beryllium Powder**, **Cadmium**, **Carbon Tetrachloride**, Chlorine, **Chlorobenzene**, Chloroform, **Cyanide**, **1,2-Dichloroethane or Ethylene Dichloride**, **1,1-Dichloroethylene or Vinylidene Chloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Endrin**, Freon 113 or CFC 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, Glutaldehyde, Hydrochloric Acid or Muriatic Acid, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, **Mercury**, Methanol, **Polychlorinated Biphenyls**, Potassium Alum (dodecahydrate), Potassium Bromide, **Selenium**, Sulfuric Acid, Sodium Carbonate, Sodium Cyanide, Sodium Sulfite, Tetrachloroethane-1,1,2,2 , **Tetrachloroethylene or Perchlorethylene (Perk)**, **Thallium**, Thiosulfates, **Toluene**, Toluene Diisocyanate (Mixed Isomers), **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**
Retail Operations	Acetone, Ammonia, **Arsenic**, **Barium**, **Benzene**, **Cadmium**, Chlorine, **2,4-D**, **1,2-Dichloroethane or Ethylene Dichloride**, Hydrochloric Acid or Muriatic Acid, **Lead**, **Mercury**, Methanol, Naphthalene or K156, Nitric Acid, Phosphoric Acid Ortho-, **Styrene**, Sulfuric Acid, Sodium Cyanide, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, **1,1,1-Trichloroethane or Methyl Chloroform**, **Vinyl Chloride**
Underground Storage Tanks	**Arsenic**, **Barium**, **Benzene**, **Cadmium**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **Lead**, Trichloroethylene or TCE
Wholesale Distribution Activities	**Benzene**, **Lead**, **Styrene**, **1,1,1-Trichloroethane or Methyl Chloroform**
Wood Preserving/Treating	Ammoniacal Copper Arsenate, Chromated Copper Arsenic, Creosote, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene,** Epoxy, Formaldehyde or K157, **Lead**, Naphthalene or K156, Polyurethane, Sulfate
Wood/Pulp/Paper Processing	Acetone, Ammonia, **Arsenic**, Ammoniacal Copper Arsenate, **Barium**, **Benzene**, **Cadmium**, Chlorine, Chlorine Dioxide, **Carbon Tetrachloride**, Chloroform, Chromated Copper Arsenic, Chromic Acid, **Copper**, Copper Quinolate, **Dichloromethane or Methylene Chloride**, **Dioxin**, **1,2-Dichloroethane or Ethylene Dichloride**, Epoxy, **Ethylbenzene**, Ethylene Glycol, Formaldehyde, K157, Hydrochloric Acid or Muriatic Acid, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, **Mercury**, Methanol, Nitric Acid, **Polychlorinated Biphenyls**, Polyurethane, Phosphoric Acid Ortho-, **Selenium**, **Styrene**, Sulfuric Acid, Gas, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE, **Toluene**, **1,1,1-Trichloroethane or Methyl Chloroform**, **Xylene (Mixed Isomers)**
Residential / Municipal	

Airports (Maintenance/Fueling Areas)	**Arsenic**, **Barium**, **Benzene**, **Cadmium**, Chlorine, **Carbon Tetrachloride**, cis 1,2- Dichloroethylene, **Dichloromethane or Methylene Chloride**, **Ethylbenzene**, Ethylene Glycol, Freon 113 or 1,1,2-trichloro-1,2,2-trifluoroethane, Hydrochloric Acid or Muriatic Acid, **Lead**, **Mercury**, Sulfuric Acid, **Selenium**, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, Urea or Carbamide, **Xylene (Mixed Isomers)**
Apartments and Condominiums	**Atrazine**, **Alachlor**, Benomyl, Bromine, Chlorpyrifos, **Coliform**, Cryptosporidium, Cyanuric Acid, Calcium Hypochlorate, Chlorine, **Diquat**, **Dalapon**, Diazinon, Epoxy, ***Giardia Lambia***, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, **Nitrate**, **Nitrite**, Nitrosamine, Oxamyl (Vydate), Phosphates, **Picloram**, Sulfate, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, **Vinyl Chloride**, Viruses
Camp Grounds/RV Parks	Benomyl, Chlorpyrifos, **Coliform**, Cryptosporidium, **Diquat**, **Dalapon**, Diazinon, ***Giardia Lambia***, **Glyphosate**, Isopropanol, **Nitrate**, **Nitrite**, Nitrosamine, Phosphates, **Picloram**, Sulfate, **Simazine**, Turbidity, **Vinyl Chloride**, Viruses
Drinking Water Treatment	**Atrazine**, **Benzene**, **Cadmium**, **Cyanide**, Flouride, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, **Polychlorinated Biphenyls**, Phosphoric Acid Ortho-, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, **Total Trihalomethanes**, **1,1,1-Trichloroethane or Methyl Chloroform**
Golf Courses and Parks	**Arsenic**, **Atrazine**, Benomyl, **Benzene**, **Chlorobenzene**, Chlorpyrifos, **Carbofuran**, **2,4-D**, **Diquat**, **Dalapon**, Diazinon, **Glyphosate**, **Lead**, **Methoxychlor**, **Nitrate**, **Nitrite**, Nitrosamine, Phosphates, **Picloram**, **Simazine**, Turbidity
Housing	**Atrazine**, **Alachlor**, Benomyl, Bromine, Chlorpyrifos, **Coliform**, Cryptosporidium, Cyanuric Acid, Calcium Hypochlorate, **Carbofuran**, Chlorine, **Diquat**, **Dalapon**, Diazinon, Epoxy, ***Giardia Lambia***, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, **Dichloromethane or Methylene Chloride**, **Nitrate**, **Nitrite**, Nitrosamine, Oxamyl (Vydate), Phosphates, **Picloram**, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, Tetrachloroethane-1,1,2,2 , Trichloroethylene or TCE, Turbidity, **Vinyl Chloride**, Viruses
Injection Wells	**Atrazine**, **Alachlor**, Benomyl, Bromine, Chlorpyrifos, Cyanuric Acid, Calcium Hypochlorate, Chlorine, **Carbofuran**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Diquat**, **Dalapon**, Diazinon, Flouride, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, Methanol, Nitrosamine, Oxamyl (Vydate), Peroxide, Phosphates, **Picloram**, Sulfate, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Tin, Trichloroethylene or TCE

Landfills/Dumps	**Arsenic**, **Atrazine**, **Alachlor**, Ammonia, **Barium**, Benomyl, **Benzene**, **Cadmium**, Chlorine, Chlorpyrifos, **Carbofuran**, cis 1,2 Dichloroethylene, **Diquat**, Diazinon, Epoxy, Ethylene Glycol, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Isopropanol, **Lead**, Lindane, **Mercury**, Methane, **1,1,1-Trichloroethane or Methyl Chloroform**, **Dichloromethane or Methylene Chloride**, **Nitrate**, **Nitrite**, Nitrosamine, Oxamyl (Vydate), Peroxide, Phosphates, **Picloram**, **Selenium**, Sulfuric Acid, **Simazine**, 1,1,2,2-Tetrachloroethane, Tin, Trichloroethylene or TCE
Public Buildings and Civic Organizations	Acetone, **Arsenic**, **Acrylamide**, **Barium**, **Benzene**, **Beryllium Powder**, **Cadmium**, **Carbon Tetrachloride**, Chlorine, **Chlorobenzene**, Chloroform, **Cyanide**, 2,4-D, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthlate**, **1,2-Dichloroethane or Ethylene Dichloride**, **Endothall**, **Endrin**, **1,2-Dibromoethane or Ethylene Dibromide (EDB)**, Formaldehyde or K157, **Lead**, Lindane, **Mercury**, Methanol, **Methoxychlor**, Naphthalene or K156, **Selenium**, Sodium Cyanide, Strychnine, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluene Diisocyanate (Mixed Isomers), **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**
Schools	Acetone, **Arsenic**, **Atrazine**, **Acrylamide**, **Barium**, Benomyl, **Benzene**, **Beryllium Powder**, **Cadmium**, Chlorine, **Chlorobenzene**, Chloroform, Chlorpyrifos, Creosote, **Cyanide**, **Carbon Tetrachloride**, **2,4-D**, Dichloride, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **Dichloromethane or Methylene Chloride**, **Diquat**, Diazinon, 1,2-Dichloroethane or Ethylene, **Endothall**, **Endrin**, Formaldehyde or K157, **Glyphosate**, Isopropanol, **Lead**, **Mercury**, Methanol, **1,1,1-Trichloroethane or Methyl Chloroform**, Naphthalene or K156, Nitrosamine, Phosphates, **Selenium**, Strychnine, Sodium Cyanide, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluene Diisocyanate (Mixed Isomers), Trichloroethylene or TCE, **Xylene (Mixed Isomers)**
Septic Systems	**Atrazine**, **Alachlor**, Benomyl, Bromine, Calcium Hypochlorate, **Carbofuran**, Chlorpyrifos, **Coliform**, Cryptosporidium, Cyanuric Acid, **Diquat**, **Dalapon**, Diazinon, ***Giardia Lambia***, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, Methane, **Nitrate**, **Nitrite**, Nitrosamine, **Oxamyl (Vydate)**, Peroxide, Phosphates, **Picloram**, Sulfate, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, **Vinyl Chloride**, Viruses
Transportation Corridors	**Dalapon**, **Picloram**, **Simazine**, Sodium, Sodium Chloride
Utility Stations	Acetone, **Arsenic**, **Atrazine**, **Barium**, **Benzene**, Boric Acid, **Cadmium**, Chlorine, **Chlorobenzene**, Chloroform, Creosote, **Cyanide**, **2,4-D**, **Dalapon**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **1,2-Dichloroethane or Ethylene Dichloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, Formaldehyde or K157, **Lead**, **Mercury**, Methanol, **Picloram**, **Simazine**, Sodium, Sodium Chloride, Sodium Cyanide, Tin, **Toluene**, 1,1,2,2- Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE, **Xylene (Mixed Isomers)**

Waste Transfer /Recycling	**Coliform**, Cryptosporidium, ***Giardia Lambia***, **Nitrate**, **Nitrite**, **Vinyl Chloride**, Viruses
Wastewater	**Cadmium**, Chloroform, **Coliform**, Cryptosporidium, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, Flouride, ***Giardia Lambia***, Isopropanol, **Lead**, **Mercury**, **Nitrate**, **Nitrite**, **Tetrachloroethylene or Perchlorethylene (Perk) Selenium**, Sulfate, Tin, 1,1,2,2-Tetrachloroethane, Trichloroethylene or TCE, **Vinyl Chloride**, Viruses
Wells	**Atrazine**, **Alachlor**, Benomyl, Bromine, Chlorpyrifos, Cyanuric Acid, Calcium Hypochlorate, **Carbofuran**, **Diquat**, **Dalapon**, Diazinon, Flouride, **Glyphosate**, Heptachlor Epoxide, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, **Dichloromethane or Methylene Chloride**, Nitrosamine, **Oxamyl (Vydate)**, Peroxide, Phosphates, **Picloram**, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, Sulfate, Tetrachloroethane-1,1,2,2 , **Tetrachloroethylene or Perchlorethylene (Perk)**, Tin, Trichloroethylene or TCE
Agricultural / Rural	
Auction Lots/Boarding Stables	**Coliform**, Cryptosporidium, ***Giardia Lambia***, **Nitrate**, **Nitrite**, Sulfate
Confined Animal Feeding Operations	**Coliform**, Cryptosporidium, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, ***Giardia Lambia***, **Nitrate**, Nitric Acid, **Nitrite**, Sulfate, **Vinyl Chloride**, Viruses
Crops - Irrigated + Nonirrigated	Acetone, Ammonia, **Benzene**, **2,4-D**, **Dalapon**, **Dinoseb**, **Diquat**, **Glyphosate**, Lindane, **Lead**, **Nitrate**, **Nitrite**, Phosphoric Acid Ortho-, **Picloram**, **Simazine**, Sulfuric Acid, Turbidity
Injection Wells	**Atrazine**, **Alachlor**, Benomyl, Bromine, Calcium Hypochlorate, **Carbofuran**, Chlorpyrifos, Cyanuric Acid, Chlorine, **Dalapon**, Diazinon, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Diquat**, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, Methanol, Nitrosamine, **Oxamyl (Vydate)**, Peroxide, Phosphates, **Picloram**, Sulfate, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE, Tin
Lagoons and Liquid Waste	**Atrazine**, **Alachlor**, **Coliform**, Cryptosporidium, **Carbofuran**, **Diquat**, **Dalapon**, ***Giardia Lambia***, **Glyphosate**, Methane, **Nitrate**, **Nitrite**, **Oxamyl (Vydate)**, **Picloram**, Sulfate, **Simazine**, **Vinyl Chloride**, Viruses
Managed Forests	**Atrazine**, **Diquat**, Benomyl, Chlorpyrifos, Diazinon, **Glyphosate**, Nitrosamine, Phosphates, **Picloram**, **Simazine**, Turbidity
Pesticide/Fertilizer/Petroleum Storage	**Atrazine**, **Alachlor**, Benomyl, Chlorpyrifos, **Carbofuran**, **Chlordane**, **2,4-D**, **Diquat**, **Dalapon**, Diazinon, **1,2-Dibromo-3-Chloropropane or DBCP**, **Glyphosate**, **Nitrate**, **Nitrite**, Nitrosamine, **Oxamyl (Vydate)**, Phosphates, Phosphorus, **Picloram**, Strychnine, **Simazine**, 2,4-TP (Silvex)

Rural Homesteads	**Atrazine**, **Alachlor**, Benomyl, Bromine, Calcium Hypochlorate, **Carbofuran**, Chlorine, Chlorpyrifos, **Coliform**, Cryptosporidium, Cyanuric Acid, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Diquat**, **Dalapon**, Diazinon, ***Giardia Lambia***, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, **Nitrate**, **Nitrite**, Nitrosamine, **Oxamyl (Vydate)**, Phosphates, **Picloram**, Sulfate, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, **Vinyl Chloride**, Viruses
Naturally Occurring	Acetone, **Arsenic**, **Barium**, **Benzene**, **Cadmium**, Calcium, Chlorine, **Chlorobenzene**, Chloroform, **Cyanide**, **Carbon Tetrachloride**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **Di(2-ethylhexyl) phthlate**, **1,2-Dichloroethane or Ethylene Dichloride**, Dichloromethane or Methylene Chloride, **Ethylbenzene**, Formaldehyde or K157, **Hexachlorobenzene**, **Hexachlorocyclopentadiene**, Iron, **Lead**, **Lindane**, Manganese, **Mercury**, Methanol, , Nitric Acid, Radionuclides, **Selenium**, Silver, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, 1,1,2,2-Tetrachloroethane, **Toluene**, Toluene Diisocyanate (Mixed Isomers), **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)

*__Bold__ - Denotes that contaminant is a National Primary Drinking Water Contaminant

APPENDIX D
POTENTIAL CONTAMINATION SOURCE INVENTORY

Source Water Protection Inventory Form

Public Water System/Area _____
Survey Date _____
Survey Conducted By _____

Landowner _____
Address _____
City _____ Zip Code _____
County _____
Type of Location _____

Contamination Source Inventory

Commercial/Industrial	#	Commercial/Industrial	#
Automotive		Slaughter Houses	
Gas Stations		Feed Lots/Manure Piles	
Service Stations		Graveyards/Funeral Services	
Body Shops		Hardware/Lumber/Parts Stores	
Repair		Home Manufacturing	
Rust Proofers		Junk and Salvage Yards	
Painting		Machine Shops, Metal Platers, Heat Transfers, Smelters, Annealers, Descalers	
Auto Washes		Mining Operations/Gravel Pits	
Auto Chemical Suppliers or Retailers		Medical/Vet Offices	
Boat Services/Repair/Refinishing		Nuclear Power Plant	
Airport Maintenance or Fueling Operations		Photo Processing/Printing	
Cement, Asphalt, Tar, Coal Companies		Plastics/Synthetics Producers	
Chemical/Petroleum Processing/Storage		Railroad Yards	
Chemical Manufacturers/Recyclers		Research Labs	
Conventional Power Plant		Small Engine Repair Shops	
Dry Cleaners/Laundromats		Specialty Chemical Company	
Electrical/Electronic Manufacturing		Stormwater Impoundment Sites	
Fuel/Oil		Truck/Fleet/Bus Terminals	
Distributors		Wood Preserving/Treating	
Pipelines		Wood/Pulp/Paper Processing and Mills	
Furniture Refinishers/Manufacture/Repair		Other	
Heating Oil Storage (commercial on-site use)			
Food Processors			
Meat Packers			

Contamination Source Inventory

Agricultural/Rural	#	Miscellaneous	#
Auction Lots		Above-Ground Storage Tanks	
Boarding Stables		Construction/Demolition Areas	
Confined Animal Feeding Operations		Historic Gas Stations	
Crops		Historic Waste Dumps/Landfills	
Irrigated		Injection Wells/Dry Wells/Sumps	
Non-Irrigated		Military Installations	
Farm Machinery Repair		Underground Storage Tanks	
Homesteads		Confirmed Leaking Tanks	
Machine Shops		Out of Service	
Single Family Septic Systems		Non-Regulated Tanks	
Lagoons/Liquid Wastes		Not Upgraded or Registered Tanks	
Pesticide/Fertilizer/Petroleum Storage. Handling Mixing, and Cleaning Areas		Upgraded and/or Registered-- Active	
Other		Wells	
Residential/Municipal	**#**	Other	
Drinking Water Treatment Plants			
Golf Courses			
Landfills/Dumps			
Septic Systems (High Density>1/Acre)			
Utility Stations (Maintenance Areas)			
Waste Transfer/Recycling Stations			
Wastewater Treatment Plants/Collection Stations			
Other			

APPENDIX E
PERMITTING PROCESS FOR NEW WELLS

Wellhead Protection Area (WHPA) Delineation Guidance

JANUARY 1999

As part of the Wellhead Protection program in DHEC's Bureau of Water, we seek to prevent wells from becoming contaminated by identifying areas of concern with regard to pollution and potential pollution sources. With the passage of amendments to the federal Safe Drinking Water Act, DHEC is developing a source water protection plan which will address both surface and groundwater sources. This guidance relates to delineating protection areas for groundwater sources via new permitting activities.

Simplified approach. The attached map delineates Wellhead Protection Area (WHPA) zones along with the four (4) tables/graphs that should be used to determine a well's WHPA. The zones are as follows:

1. Piedmont Regions 1 and 2 - Zones 1 and 2
2. Coastal Plain Sand Aquifers - Zone 3
3. Coastal Plain Limestone Aquifer - Zone 4

Each of the four zones has a corresponding table and equivalent graph. The graphs are a convenient way for applicants to identify the WHPA radius based on the proposed pumping rate. Data for the tables and graphs were generated using two methods. Data for zones 1 and 2 are based on volumetric formulas in accordance with DHEC's Wellhead Protection Program Guide, dated November 1997 (i.e., fixed radius method). Data for zones 3 and 4 are based on wellhead protection computer models.

To delineate the proposed well's WHPA you should first determine in which zone the well is to be located. Once determined, you should proceed to the appropriate table or graph and use the estimated well pumping rate to determine the WHPA radius.

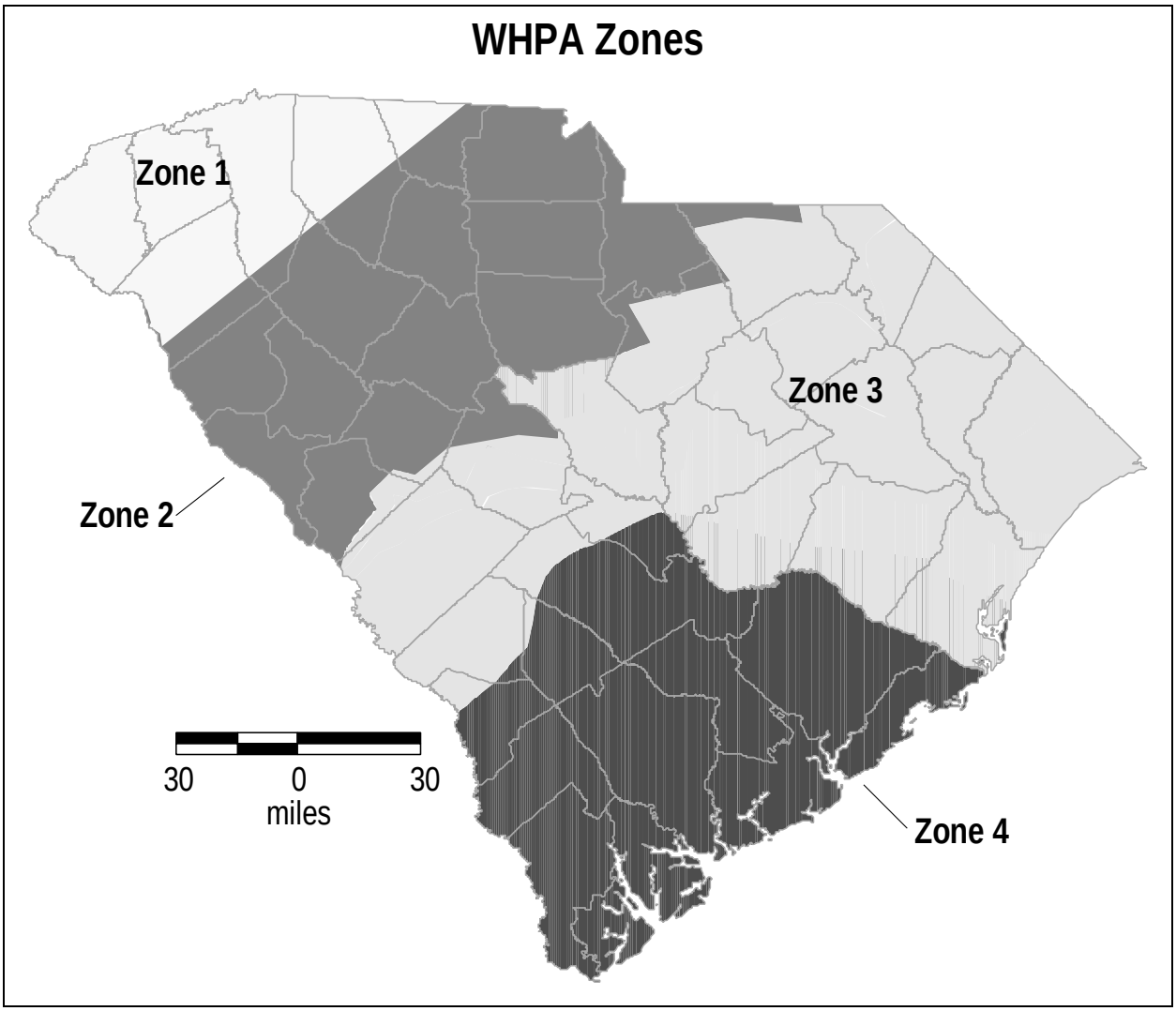
Note that once the WHPA has been determined then a complete inventory must be taken within the area and submitted to DHEC with the project application.

Alternative approach. Permit applicants may wish to use other models to determine the WHPA. DHEC will critique the model selected and concur with it if it is an appropriate tool.

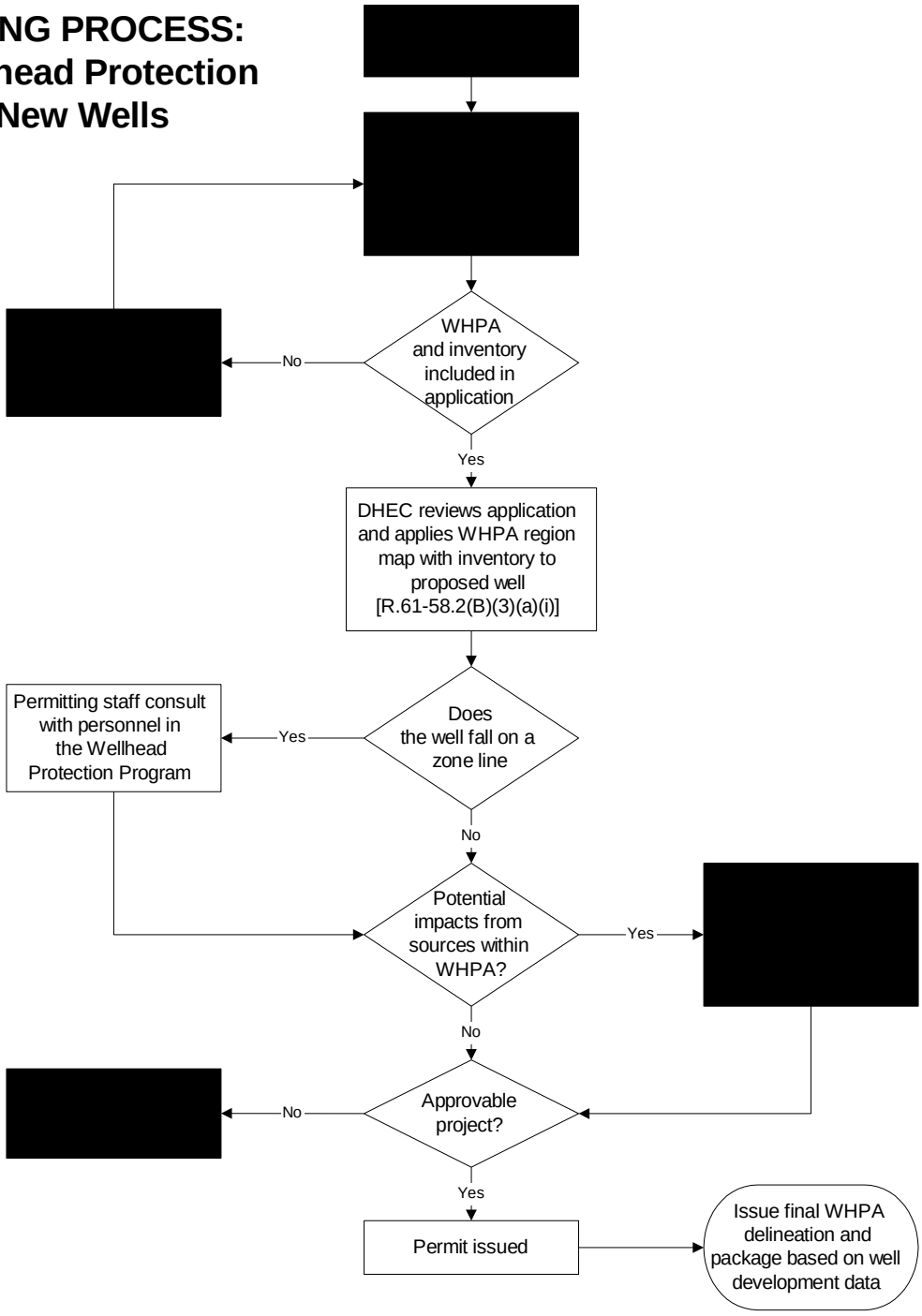
What next. Once a WHPA is established, state regulation 61-58 requires that permit applicants locate all real or potential sources of pollution. DHEC requests that this information be provided on USGS topo maps or equivalent so we can transfer the information to our GIS data base. A sample guide to develop an inventory for an area is attached.

If there are any questions on our permitting process, please contact Chris Childs, Manager of DHEC's Water Supply and Recreational Waters Permitting Section (843-898-3820). A flow chart on our permitting process regarding WHPA issues is attached.

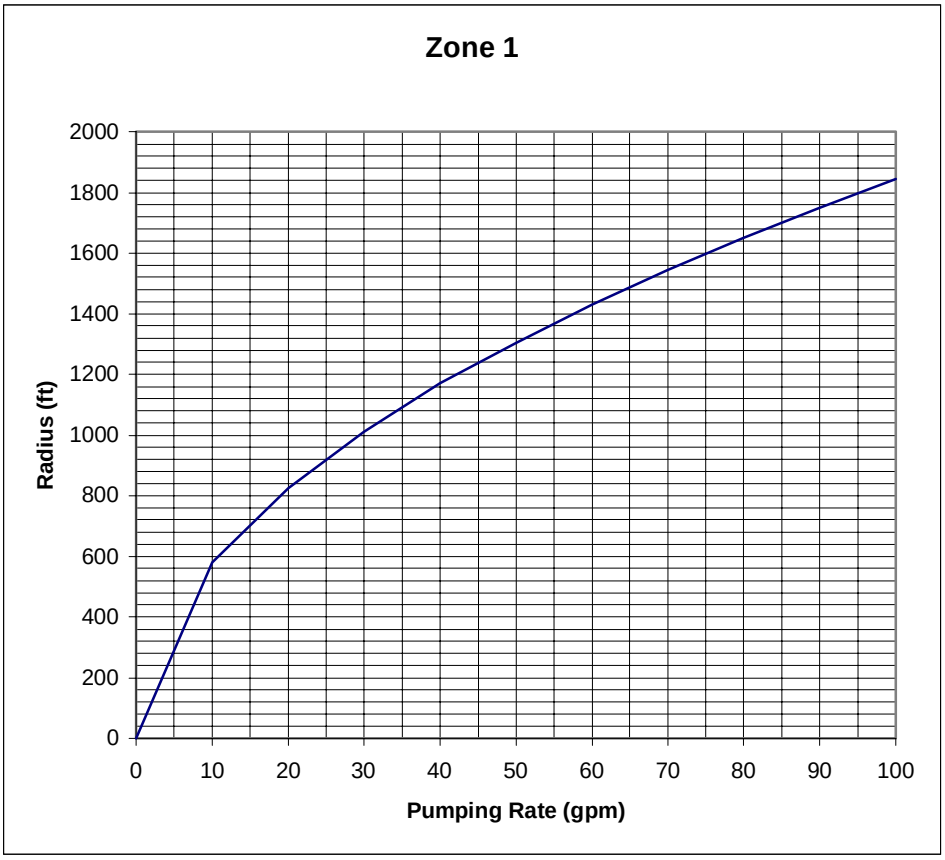
D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health
and Environmental Control


WHPA Zones
Zone 1
Zone 2
Zone 3
Zone 4
30
0
30
miles

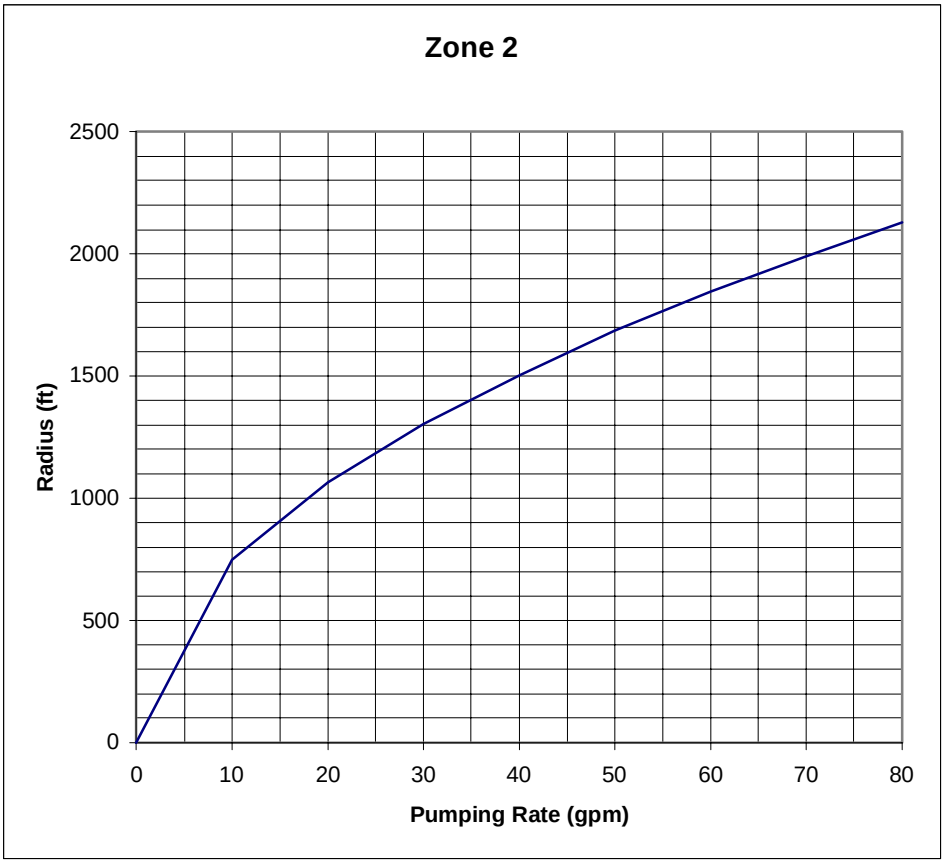
PERMITTING PROCESS: ID of Wellhead Protection Areas for New Wells



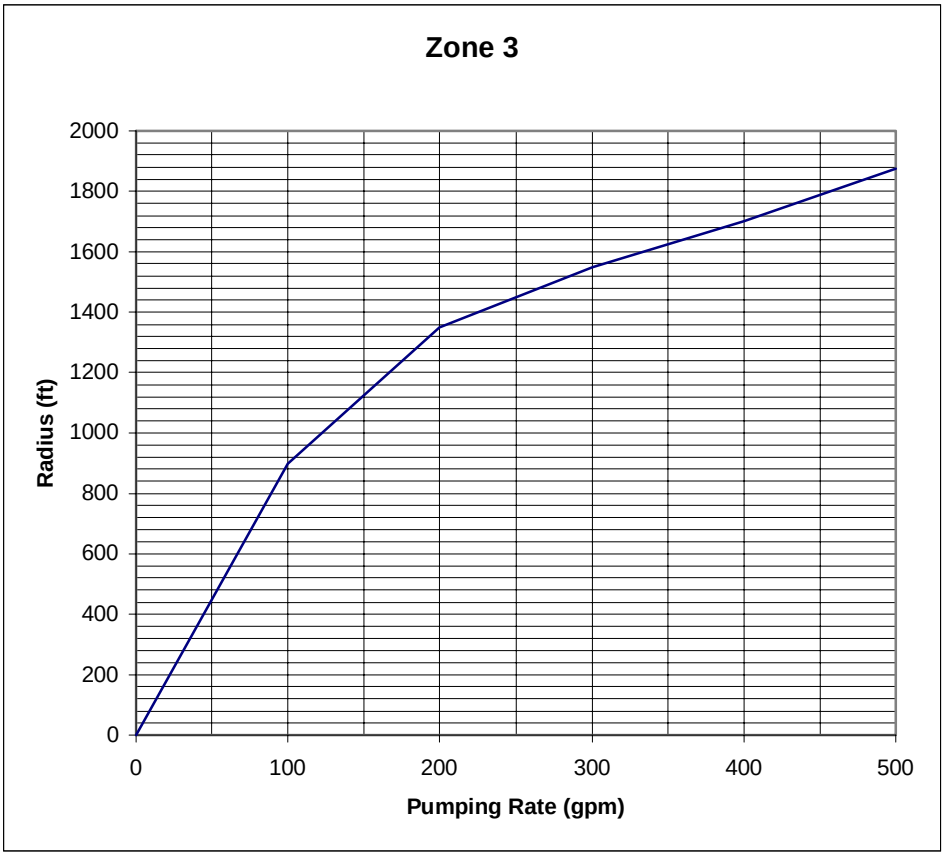
1/99



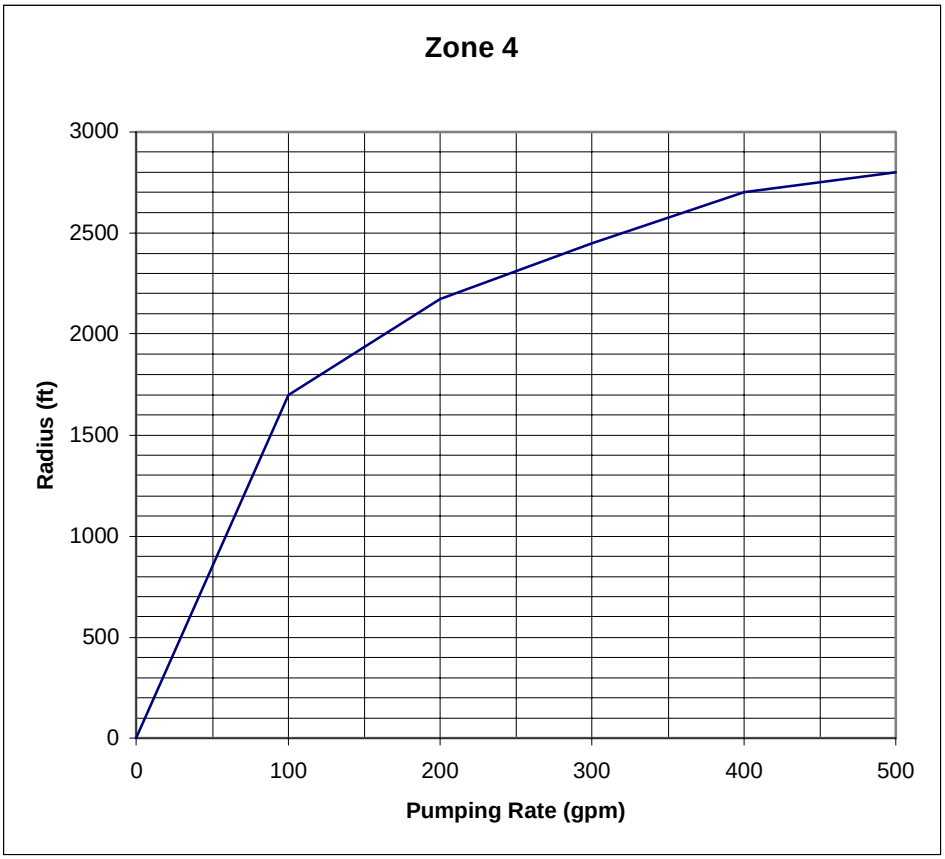
WHPA Chart



WHPA Chart



WHPA Chart



WHPA Chart

Wellhead Protection Inventory Guide

Public Water System/Area _____

Survey Date _____

Survey Conducted By _____

Landowner _____

Address _____

City _____ Zip Code _____

County _____

Type of Location _____

Contamination Source Inventory			
Commercial/Industrial	**#**	**Commercial/Industrial**	**#**
Automotive		Slaughter Houses	
Gas Stations		Feed Lots/Manure Piles	
Service Stations		Graveyards/Funeral Services	
Body Shops		Hardware/Lumber/Parts Stores	
Repair		Home Manufacturing	
Rust Proofers		Junk and Salvage Yards	
Painting		Machine Shops, Metal Platers, Heat Transfers, Smelters, Annealers, Descalers	
Auto Washes		Mining Operations/Gravel Pits	
Auto Chemical Suppliers or Retailers		Medical/Vet Offices	
Boat Services/Repair/Refinishing		Nuclear Power Plant	
Airport Maintenance or Fueling Operations		Photo Processing/Printing	
Cement, Asphalt, Tar, Coal Companies		Plastics/Synthetics Producers	
Chemical/Petroleum Processing/Storage		Railroad Yards	
Chemical Manufacturers/Recyclers		Research Labs	
Conventional Power Plant		Small Engine Repair Shops	
Dry Cleaners/Laundromats		Specialty Chemical Company	
Electrical/Electronic Manufacturing		Stormwater Impoundment Sites	
Fuel/Oil		Truck/Fleet/Bus Terminals	
Distributors		Wood Preserving/Treating	
Pipelines		Wood/Pulp/Paper Processing and Mills	
Furniture Refinishers/Manufacture/Repair		Other	
Heating Oil Storage (commercial on-site use)			
Food Processors			
Meat Packers			

Contamination Source Inventory			
Agricultural/Rural	#	**Miscellaneous**	#
Auction Lots		Above-Ground Storage Tanks	
Boarding Stables		Construction/Demolition Areas	
Confined Animal Feeding Operations		Historic Gas Stations	
Crops		Historic Waste Dumps/Landfills	
Irrigated		Injection Wells/Dry Wells/Sumps	
Non-Irrigated		Military Installations	
Farm Machinery Repair		Underground Storage Tanks	
Homesteads		Confirmed Leaking Tanks	
Machine Shops		Out of Service	
Single Family Septic Systems		Non-Regulated Tanks	
Lagoons/Liquid Wastes		Not Upgraded or Registered Tanks	
Pesticide/Fertilizer/Petroleum Storage. Handling Mixing, and Cleaning Areas		Upgraded and/or Registered-- Active	
Other		Wells	
Residential/Municipal	#	Other	
Drinking Water Treatment Plants			
Golf Courses			
Landfills/Dumps			
Septic Systems (High Density>1/Acre)			
Utility Stations (Maintenance Areas)			
Waste Transfer/Recycling Stations			
Wastewater Treatment Plants/Collection Stations			
Other			

APPENDIX F
SCDHEC RESPONSE TO U.S.EPA COMMENTS AND U.S. EPA APPROVAL LETTER

D H E C
PROMOTE PROTECT PROSPER
2600 Bull Street
Columbia, SC 29201-1708

October 19, 1999

Re: South Carolina Source Water Assessment
and Protection Program

Dear Technical and Citizens Advisory Committee Member:

Please find enclosed the Department's responses to EPA's comments on the draft Source Water Assessment and Protection Plan. We anticipate EPA approval of the plan in November.

I would also like to take this opportunity to update you on our progress to date. Delineation of the source water protection areas for both groundwater and surface water systems are currently underway. We expect delineations for the surface water intakes will be completed by Spring 2000. The wellhead protection areas should be completed by late 2000 or early 2001. The next "phase" will be to conduct inventories of potential contamination sources within the delineated protection areas.

If you have any questions, please call me at (803) 898-4272 or e-mail me at "baizedg@columb32.dhec.state.sc.us."

Sincerely,

David G. Baize, Director
Water Monitoring, Assessment, & Protection Division
Bureau of Water

ENC: Letter to EPA

D.B./swpadv2.ltr

DHEC Responses to EPA Comments
dated June 21, 1999

EPA comments are summarized in bold type below. EPA comments related to approvablity of the plan are shown in ***italics***.

A. SC Facts/Statistics

There are 1350 "state" water supply systems that do not meet the minimum federal definition. Will SC apply the SWAP to the "state" water supply systems?

No assessments of the state systems are planned at this time.

B. General Comments

1. Clarify implementing agency.

Agree. We will clarify that DHEC is the implementing agency.

2. It would be helpful to provide a "walk-through" example.

Results of actual assessments will be made available when completed.

3. What is the relationship between the watershed/basin planning cycle or with TMDL development? Has the state made any linkages with it's Pollution Prevention program for source water protection activities?

Inventories completed for the SWAP will be made available for use in basin planning and TMDL development. Also, water quality violations resulting in a 303(d) listing will be evaluated during the SWAP (see for question 5(d) under the susceptibility heading for additional detail). Should a potential source be identified as a "high susceptibility" as a result of the assessment, the pollution prevention program will be contacted for potential assistance in addressing ways to reduce that risk.

4. Does SC intend for the assessments to be revisited and updated on a periodic basis?

As there are currently no resources being provided to states to perform this function, we anticipate that local teams will be formed (water suppliers, local governments, etc.) that will update the assessment information on a voluntary basis.

5. Is the same assessment methodology to be used for all systems (community, noncommunity, etc.).

We will utilize the same methodology for all systems. Although the noncommunity or transient systems serve smaller populations, they may have a higher potential of

becoming impacted by identified threats (due to depth of wells, etc.).

C. Public Participation

1. Key issues from the 1997 EPA guidance were discussed during the Technical and Citizens Advisory Committee meetings. What were the Technical and Citizens Advisory Committee's responses and how did the state respond to the responses?

Meeting notes are included in Appendix A.

2. Please provide the minutes from the 1/20/99 meeting.

Meeting notes are included in Appendix A.

E. Public Water Supply System Assessments

1. Groundwater Delineation

b. Clarify the relationship between Table 1 and the 1-5-10 year time-of-travel (TOT).

Figure 12 outlines three areas of relative aquifer vulnerability (Area 1 high, Area 2 moderate, and Area 3 low). Based on the location of a well in each aquifer vulnerability area, potential sources identified within the capture zone (regardless of the 1-5-10 year TOT) will be assigned a susceptibility ranking as described in Table 1.

2. Surface Water Delineation

a. What is the justification of the 24 hour TOT?

Rather than using an arbitrary distance to delineate the upstream boundary of the source water protection area, a variable distance based on flow was chosen. A 24 hours time-of-travel was used for optimal protection of the water intake should an in-stream release occur (i.e., emergency response).

b. For reservoirs, will all head waters and tributaries to the reservoir be delineated for the 24 hour TOT (not just the main stem)?

Yes.

c. Define 10% exceedance flow.

The discharge that has been exceeded only 10% of the time for a designated time period of analysis. This is a very conservative value and increases the upstream distance of the protection areas.

3. **Groundwater Under the Direct Influence**

a. How will the potential contaminant source inventory and susceptibility determination be handled for these systems?

As described on page 9, sources determined to be under the influence of surface water will have conjunctive delineations. Therefore, an inventory of both surface and ground water protection areas will be performed.

b. Approximately how many systems in SC have been determined to be GWUDI? Have all systems been evaluated?

All systems identified as potentially being GWUDI have been evaluated. Currently, no systems have been determined to be under the direct influence.

c. Please clarify if the limestone aquifer is karstified, and if so, how the state will address this area of the state?

There is a very limited area of karst in the Santee area. Many wells are installed through this surficial unit into lower aquifers. Should a public supply well be completed into the shallow karst unit, this will be treated as the most vulnerable hydrogeologic setting.

4. **Inventory**

a. Will the windshield survey include establishing a GPS location for facilities inventoried by the windshield survey that were missed by the computer record search? Will the windshield survey verify the locational accuracy of the potential contaminant sources identified in the database search?

Yes, a GPS location for facilities identified by the windshield survey will be obtained. The windshield survey will also verify the presence of the potential contaminant sources identified from the database search.

b. How long before the web browser interface is in place for Internet access to assessment information?

We anticipate access will be available after completion of the assessments.

c. Will the computer search extend beyond areas 1-2-3 for groundwater systems, or Zones 1-2-3 for surface water systems?

For groundwater systems, the computer search will be for the 10 year TOT or otherwise calculated WHPA. For surface water systems, the computer search will be for the entire protection area (i.e., zones 1, 2 and 3).

d. Please clarify if the inventory and susceptibility determination will be done up to the 10 year TOT for groundwater and GWUDI systems.

Correct.

e. Please provide a table that references the existing databases that will be used to populate potential contaminant inventories with the specific facilities that are covered by the listed database. Also, provide a metadata discussion for each database that will be used.

POTENTIAL CONTAMINANT SOURCES

Existing Database	Owner	Data Type	Metadata
BOWSITES	SCDHEC - BOW	Unregulated Spills & Leaks UIC Class V	GPS - UTM WGS84
USTSITES	SCDHEC - UST	Regulated Underground Storage Tanks	GPS - UTM WGS84
NPDES-PIPES	SCDHEC - BOW	NPDES End of pipe	GPS - UTM WGS84
LANDFILLS	SCDHEC - BLWM	Domestic, Industrial, & Municipal Solid Waste Land	1:24,000 TOPO UTM
HWTSD	SCDHEC - BLWM	Hazardous Waste Treatment Storage & Disposal	1:24,000 TOPO UTM
CERCLA	SCDHEC - BLWM	Comprehensive Environmental Response Compensation & Liability Act	1:24,000 TOPO UTM
DRYCLEANERS	SCDHEC - BLWM	Drycleaners	GPS - UTM WGS84
TRI	SCDHEC - All Bureaus	Toxic Release Inventory	1:24,000 TOPO UTM

BOW - Bureau of Water
UST - Underground Storage Tank Division
BLWM - Bureau of Land & Waste Management
GPS UTM - Position located within 3 meters
TOPO UTM - Position located by Topographic Quad
WGS84 - State geographic datum used for corrections

f. Will the state or water systems conduct the inventory work?

The state will conduct the inventories.

g. Appendix D: Although UICs are listed generically on the inventory form, the state should list the types of facilities that are typically associated with having UIC wells, especially for the Class V wells.

This form will be revised for clarity.

h. Please clarify that above ground storage tanks and industrial treatment/storage surface impoundments are included as potential contaminant sources and clarify where on the potential contaminant inventory form they would be recorded.

Both of these are listed in the form in Appendix D.

5. **Susceptibility Determination**

a. Please confirm EPAs understanding of the proposal that:

1) Individual potential contaminant sources (including all Appendix C facilities) will be inventoried by a computer search and by a windshield survey.

Correct

2) These facilities will be cross referenced with the potential contaminant listing associated with each type of inventoried facility.

Correct

3) A susceptibility determination will be made using the analysis methodology provided.

Correct

b. Please clarify how the state will determine susceptibility for a potential contaminant source with multiple potential contaminants. For monitoring waiver purposes, the state may need to conduct a susceptibility determination for each class of potential contaminants identified.

A susceptibility determination will be made for each class of potential contaminant present (e.g., gasoline and solvents present at an auto repair operation). The facility will be listed by the "highest" susceptibility determination.

c. Sources of nitrates and other nonmetallic inorganic chemicals are not addressed by the proposed methodology.

These were listed in Appendix B to be addressed, but were not included in Tables 1 and 2. This will be corrected.

d. Has the state considered evaluating MCL violations and "occurrence" data for surface water systems as a factor in the susceptibility determination? Does the state require any type of raw water monitoring for surface water systems?

South Carolina requires raw water to be monitored for turbidity and coliforms as required by the Surface Water Treatment Rule.

Should we identify MCL violations at any of our ambient surface monitoring water stations located within a SWPA, an "high susceptibility" value will be assigned to that contaminant class for that system. This information will then be provided to the Bureau of Water's Water Quality Division for appropriate action associated with TMDL development.

e. P.19. Please provide an explanation of the differences in areas 1, 2, and 3 shown on figure 12.

The map represents relative incidence of finding dissolved nitrate above 0.1 mg/l in public-supply wells. Nitrate is used as a tracer or index of influence of the surface environment on typical public supply wells. This threshold concentration was used because it (1) provided a convenient three-tiered sorting with contiguous areas, and (2) the results conformed closely to regional vulnerability assessments using other criteria (e.g., geology, environmental isotope tracers, contamination incidents).

f. p. 19-20. In describing areas 1, 2, and 3, use "any <u>potential contaminant</u> source..." This differentiates potential contaminant source from a drinking water source.

Agree

g. EPA encourages the state to develop guidance for public water systems operators in groundwater area 1 (fig. 12) to assist them in prioritizing potential contaminant sources since all are given a "high" susceptibility determination. Please explain how assigning all a "high" makes the inventory useful.

"High" susceptibility implies that if a release occurs at such a facility there is a high probability of impacting the water source. Based on the hydrogeologic conditions in Area 1 (minimal saprolite overburden and fractured crystalline rock aquifer), further sub-dividing risks associated with different types of contaminants are not significant at the "Level l" of susceptibility analysis (i.e., contaminant type and location). Implying relative differences in susceptibility based solely on this information implies a precision which may be misleading. For example, a release of gasoline, nitrate, or chlorinated solvents within a WHPA in Area 1 all have the potential of rapidly traveling through fractures in the bedrock aquifer. Further refinement of the potential contaminant sources will be necessary in the "Level 2" susceptibility analysis (e.g., volume stored, existence of BMP's, etc.).

h. In the last sentence of the second full paragraph on page 19, please clarify that the susceptibility determinations process will determine the susceptibility of the source water relative tot he potential contaminant sources. Also, anytime the document says "source", please indicate if it is referring to a "potential contaminant source" or "source water".

Agree.

I. Please submit a copy of the well construction regulations for S.C. Was the advisory committee familiar with the content of these regulations when it was reviewing the proposed susceptibility determination process?

A copy of the regulation is enclosed. Some of the water suppliers on the committee were familiar with these regulations.

F. Public Availability of the Assessments

1. Section 5.2, the last sentence must be revised to state that the results of the source water assessments must be provided to each consumer through the CCR regardless of system size, in accordance with the CCR regulations. The state should also indicate what will be included in source water assessment summaries that will be provided by the state to each PWS for inclusion in their CCR.

We will revise this to indicate that all Community Water Systems must include a segment on source water protection in their CCR. All items required by EPA will be provided for inclusion in their CCR.

2. Maps generated through the implementation of the source water assessments should include political jurisdiction (county lines) and major highways as points of reference.

Agree.

G. Program Implementation

Expand the discussion of intrastate coordination of SWAP activities and its coordination with its federal partners (database sharing, prioritization of nonpoint source program, Section 319, funding or federal agency activity prioritization within source water protection areas).

The SWP Program is located within DHEC's Bureau of Water. This bureau is responsible for all water programs delegated by EPA, so sharing of information and input from the nonpoint, 319, and other programs.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

OCT 29 1999

Mr. Douglas E. Bryant, Commissioner
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201-1708

Dear Mr. Bryant:

Section 1453 of the 1996 Amendments to the Safe Drinking Water Act requires states to develop Source Water Assessment Programs (SWAPs). The U.S. Environmental Protection Agency (EPA) has received and reviewed South Carolina's SWAP submitted on February 4, 1999. The subsequent state response dated October 6, 1999, to EPA's comments has also been reviewed. Based on our review, the EPA is proud to inform you that the South Carolina SWAP is hereby approved, effective November 6, 1999.

The EPA encourages South Carolina to continue its dialogue with the SWAP technical and citizen advisory committee(s) during the implementation of the South Carolina SWAP. EPA also encourages the state to facilitate drinking water source protection efforts at the local level.

South Carolina's request for an 18-month extension of the deadline for completion of the source water assessments is hereby granted. The statutory deadline for completion of the assessments is 24 months from the approval of the program. Based on the 24-month deadline, and the granted 18-month extension, South Carolina's deadline for completion of source water assessments is May 6, 2003.

Again, I commend South Carolina for its significant commitment and effort to assess and protect drinking water sources. If I may be of further assistance, please do not hesitate to contact me.

Sincerely,

John H. Hankinson, Jr.
Regional Administrator

cc: Mr. David Baize, Director - Water Monitoring, Assessment, and Protection Division, DHEC